The Builder.

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The "Practical" Column.

LESS than fifty years ago the design and erection of the largest buildings involved little or no engineering knowledge. In the absence of the various structural and other engineering details that characterise buildings of the present day, the architect was practically free to devote the whole of his attention to the design, and to its effective realisation in materials which were thoroughly familiar to him. The builder had merely to erect enclosing walls of moderate thickness, of strength and stability that were generally far greater than the forces to be resisted, and within the walls only the most simple forms of construction were employed. At the present time, although the American system of building has not been adopted in this country, the use of steelwork is almost universal in all important structures. Even in such comparatively insignificant buildings as shops and business premises, it is unfortunately by no means unusual to find the entire front carried on steel girders, supported in turn by steel columns. Frequently the safety of an entire building appears to depend on the adequacy of one corner column for its required duty. If the architect leaves the design of such members to a contracting firm, serenity of mind and a sufficiency of that refreshing sleep which is so necessary for the human system can only be obtained by the exercise of an undesirable amount of confidence in persons beyond his control. On the other hand, if all the calculations be performed under his direct supervision, he may be puzzled by the remarkable differences in the results given by various formulas, none of which do more than to afford what Rankine calls "roughly approximate" expressions for experimental results.

In consequence of the embarrassingly varied estimates of strength furnished by the formulas in general use, ordinary people are content to adopt some simple rule, and to rely with unquestioning faith upon the approximations thereby obtained. Others who aspire to greater accuracy employ more scientific formulas as they stand, or as qualified by practical experience. Thus divergencies are perpetuated and will inevitably continue until rules in which empirical factors are predominant shall be displaced in favour of a formula based upon a logical and consistent theory, covering the varied conditions encountered in practice. A praiseworthy attempt in this direction has been made in a paper on "The Practical Column under Central or Eccentric Loads," read last year by Mr. J. M. Moncrieff, M.Inst.C.E., before the American Society of Civil Engineers. In developing his theory and the resulting formula, the author aims at correctness of form without unnecessary mathematical refinements. He maintains that the theory ought to show agreement with, and be a reasonable explanation of, experimental results, and that the formula should have a wide range of application, and be free from empirical factors as far as possible. The reasoning adopted is strictly logical, but nowhere involves the use of the higher branches of mathematics, and consequently is within the comprehension of all. This treatment is entirely to be commended, and may be probably attributed to the fact that the author, as a practising engineer, has learnt the lesson that unnecessary complexity is a thing always to be avoided. The underlying principles of the reasoning are "that a perfectly centred column of perfect material and straightness is an ideal conception seldom or never realised in practice, and that the various influences preventing the realisation can be, as regards their ultimate effect, represented by an equivalent eccentricity of loading." Athough the want of coincidence of the physical axis of resistance and the geometrical axis of the ordinary, or practical, column is known, none of the formulas in common use make the least provision for such eccentricity. Further, very few writers on the subject of column design seem to appreciate the important influence of eccentricity of loading, which may be accidental and small in columns under presumably central loads, or intentional and large in columns under eccentric loads. Most of the columns in buildings are short, and as even loading is quite exceptional, the element of eccentricity is a most important one for the architect. As writers of scientific works ordinarily overlook this essential consideration, it is not unreasonable to suppose that the average architect may do the same, and Mr. Moncrieff has done great service in defining the influence of accidental and known eccentricity, and in furnishing means for determining its effect upon the strength of columns. His theory takes proper account of the "accidental" eccentricity always found in the practical column, and also of the other causes that prevent it from behaving as it would if the materials and workmanship were perfect. Of the latter, mechanical treatment before use, and the process of building up a riveted steel or iron column, have marked effects, in the one case causing internal stresses and qualifying elastic resistance, and in the other producing twisting and curvature, although the column may look straight. As for cast-iron columns, the hidden defects and internal stresses that can never be avoided must inevitably affect strength to a serious extent. All disturbing influences, of which these are examples, are considered by Mr. Moncrieff as being equivalent to actual eccentricity, and are termed "equivalent" eccentricity. Assuming this theory to be true, it becomes evident that if all the elements of error be covered by one factor, the resulting formula should apply to the ideal column when the factor in question is reduced to zero.

In his discussion of theoretical principles, the author commences by considering the stress diagram and resulting deflection of a beam, as involving principles equally applicable to the case of a round-ended column under eccentric load, and leads up by easy steps to a general equation for deflection. An inspection of this formula shows that if ideal conditions were assumed the corresponding adjustment of values would reduce the equation to a form which, by transposition, gives the ultimate load of the ideal column, $P = \pi^2 EI \div l^2$. This is at once recognisable as Euler's formula, of which the purely theoretical accuracy is unquestioned. Hence, the author's formula appears to be based on correct principles and to be in correct form. Another matter considered is the influence exercised on the deflection, and therefore on the strength, of a column by a small amount of initial curvature. Curvature may be positive, acting with eccentricity to increase deflection; or

negative, acting against eccentricity, to decrease deflection, and a consideration of its effects will explain why two columns of identical material and dimensions, but in one of which there is slight positive curvature, and in the other slight negative curvature, may afford extremely divergent results when tested. The curvature may be difficult of detection, or it may be absolutely hidden if applying to the physical axis of a column whose outward form is perfectly straight. We are now able to see why the author considers it appropriate to include in one factor accidental eccentricity and other influences which are practically equivalent to eccentricity. In his formula expressing the maximum stress in a column under presumably central load, there is only one empirical factor, including accidental and equivalent eccentricity and a term representing the influence of sectional form. The latter could be calculated for any given section, but as the influence of form of section has not yet been precisely verified by experiment the term is at present treated as a constant. As the formula is given, it is suitable for determining the value of the recognised ratio, $l \div r$, corresponding to a given direct load per square inch of section in a round-ended column. When used for fixed-ended columns the results must be doubled, as such columns may have twice the length of round-ended columns with equal safety; and when used for columns with flat ends, not absolutely fixed, the results may be doubled up to a certain point, beyond which a special modification of the rule is necessary.

Attention may now advantageously be directed to the ancient and oft-repeated error that columns with flat ends are three times as strong as similar columns with rounded ends. Sometimes the error is mitigated by a reduction of the multiple to 2, and at others aggravated by its increase to 4, but it cannot be too emphatically stated that no such relations exist between fixed-ended columns as a class and round-ended columns as a class. Very short columns yield by crushing under direct compression; hence at the ratio, $l \div r = 0$, assuming such a state to be possible, two columns, one with fixed ends and the other with round ends, but otherwise identical, must be of equal strength. As the proportion of l to r increases, deflection becomes a factor for consideration, and the columns fail partly by crushing and partly by flexure. The condition of the ends has an influence upon the amount of the stresses set up, which increases in value with the ratio $l \div r$, and divergence of behaviour between the two types of columns becomes evident, a condition that is accentuated when compression ceases to be the controlling factor. Therefore, while starting at equality, the relative strengths of the two columns vary with every increment of the ratio, $l \div r$, until in exceedingly long columns the type with fixed ends might not fail before three or more times the load had been imposed that would suffice to cause failure of the round-ended type. But it is misleading and highly undesirable to say that one class has two, three, or four times the strength of the other, especially as at the ratio, $l \div r = 60$ — by no means unusual in building construction — the relative strengths of fixed and round-ended columns of wrought iron and steel are approximately as 1.2 is to 1. As for cast iron, no tests of its commoner qualities have been made from which definite comparisons can be drawn, but it would not be safe to accept a higher proportion for cast iron than for wrought iron and steel. Hodgkinson's experiments only provide material for the comparative examination of round and flat-ended columns of Lowmoor iron, and they are not applicable to ordinary qualities.

Examination of the numerous diagrams in Mr. Moncrieff's paper will demonstrate the absolute inaccuracy of the assumption to which the foregoing remarks apply. Another point seldom made clear is the difference between columns with "fixed" and "flat" ends. Scientific writers frequently treat the terms as synonymous, and none of the rules in common use provide for the difference of behaviour that undoubtedly exists. The stress diagram of a fixed-ended column under load includes three figures, one for each end and one for the central portion between the points of contrary flexure. Mr. Moncrieff demonstrates that the central portion is equal to one-half of the total length, thus showing why a column with fixed ends may have double the length of one with round ends for the same load—quite a different thing from saying that it has double the strength. It is clear that tensile stress may be developed at the ends of a fixed-ended column, but none can be set up at the unfixed ends of a flat-ended column. Up to the point at which the load would tend to set up tension a flat-ended column will act as one with fixed ends, but when that point is passed it will begin to rotate on its bearing surfaces and will be in a highly unstable condition, when a small increase of load would probably cause failure. The condition is described by the author as due to "incipient tension," and is to be determined by a modification of his formula. This part of his paper deserves careful study, as it certainly embodies the first attempt to arrive at a rational basis for the strength of flat-ended, as distinguished from fixed-ended, columns. A strictly practical matter treated in the same section of his essay is the rarity of absolute fixation even in columns with presumably fixed ends. The ends may be securely connected to some other parts of a structure, but this in no way ensures the conditions which make it safe to calculate strength by any formula based upon the assumption that the ends are absolutely fixed. In building construction the objection seldom applies, because most of the columns used are well below the ratios at which divergence of behaviour becomes manifest.

As the starting point for the theory and formula was the development of an expression for the deflection of a column, it is important to see whether the deflection formula shows agreement with the results afforded by tests. This condition is demonstrated to be reasonably fulfilled in the next section of the paper, and a lengthy comparison is then instituted between the calculated and actual strengths of columns of various materials and forms, the calculations being made by the author's formula or modifications thereof, whilst actual strengths are furnished by nearly all the trustworthy results that have been published since the time of Hodgkinson. All these results, to the number of 1,620, representing 1,789 tests, are plotted in terms of $l \div r$, so that they may be readily compared with the calculated curves of strength. Considerable variations appear for the same materials, and actual column strength is therefore suggested by a broad curved band rather than by a geometrical curved line. Consequently, Mr. Moncrieff has adopted the convenient course of assigning values for the factor representing eccentricity and other disturbing influences approximately corresponding (a) with the highest results and (b) with the lowest results. Two calculated curves are thus obtained for each diagram, representing the upper and lower limits of strength, and between these the ultimate strength of an average column will lie. The comparison, extending to twenty-nine diagrams of results, is quite sufficient to support the author's contention that his formula is both rational and in fair agreement with the most reliable records. It also throws light on other points. For instance, apart from Hodgkinson's tests of Lowmoor iron, which cannot be taken as applying to common qualities, there are no published records of tests of cast-iron columns made in a consistent and scientific manner, and the only other records as to cast-iron really afford no sufficient justification for the formulas in general use. Again, numerous diagrams illustrative of tests by Mr. Christie, Professor Tetmajer, Mr. Marshall, and others on flat-ended wrought-iron and steel columns tend to confirm the general accuracy of the author's theory as to "incipient tension." In his experiments on wrought-iron flat-ended struts Mr. Christie found failure by rotation at the ends frequent in the longest struts and invariably absent in the shortest. The note should also be made that some of the pin-ended columns included in the diagram actually failed by deflection in a direction parallel to the pins, thus showing that they really acted as flat-ended and not as pin-ended columns. Although this result merely suggests that the columns were of less strength in a direction parallel to the axis of the pins than in a direction perpendicular to them, it serves to indicate the necessity for great care in the design of columns where such conditions may be existent. Very few records are available with regard to eccentrically loaded columns, and this accounts for the limited extent of the comparison so far as concerns intentionally eccentric loads.

In applying Mr. Moncrieff's rules in ordinary practice, they can be used, as in the comparative investigation to which we have alluded, to indicate the ultimate strength of various types of columns. This course is not advised by the author, who thinks it better to design columns "so as to ensure that given maximum fibre stresses will not be exceeded under the working load," and at the same time he considers it necessary to provide against failure by instability in the longer lengths. The first condition is readily ensured by adopting suitable values for the physical constants, and in assigning a value for the factor representing accidental and equivalent eccentricity that is in accordance with the diagrams of experimental results. The second condition is attained by qualifying the value of E, the modulus of elasticity, by a factor of safety, which has little influence on short columns, but whose effect increases gradually with the length, ultimately affording a factor of safety of

3 against instability in exceedingly long columns. Writers on the subject of columns generally treat stiffness in conjunction with strength, apparently considering that these two properties are too much dependent on each other to be separated. Mr. Moncrieff follows a much more correct course in demonstrating that two independent modes of failure have to be provided against: (1) by excess of stress intensity, and (2) by instability. To show the logical nature of this argument, he gives a diagram containing two curves, one dealing with working loads on mild steel columns, as limited by safe stress intensity, and the other ensuring that the working loads shall not cause instability. The first of the curves is calculated by the ordinary form of the author's equation, and the second by what is practically Euler's formula with the addition of a coefficient of safety. By the curves it becomes clear that above and below the point where $l \div r = 88$, the loads indicated by the stress curve would inadequately provide for stability, and obversely, that the loads shown by the stability curve would not sufficiently provide for strength. Whilst the rules by which the two curves are calculated demonstrate the independent character of both strength and stiffness, there are practical and other reasons why one equation only should be adopted in ordinary use. Such an equation is afforded by the author's formula when the factor of safety against instability has been included. The formula is then applicable to columns of various classes and materials, under either "central" or eccentric loads, convenience and simplicity being attained by the tabulation of working equations. Taking those for mild steel under "central" loadings, as examples, we have for round-ended columns:—

$$\frac{l}{r} = 10\sqrt{\frac{480}{12 - 4.4 f_d}\left(\frac{2.4}{f_d}\right) - 1.6}\,;$$ for fixed-ended columns double the results thus obtained; and for incipient tension in flat-ended columns, $\frac{l}{r} = 2.138\sqrt{\frac{3{,}000}{f_d}}$.

In all the above working equations the average intended direct load per square inch must be inserted in units of 10,000 lbs. each. We can now see that from these rules a series of curves can easily be calculated, giving as before the ratio of $l \div r$, corresponding with any required safe dead load per square inch of column section. When the curves have once been plotted for office use, no further calculations of the same kind are again necessary, and for any given section and length of column two things only have to be done: (1) to divide the length (l) by the radius of gyration (r), and (2) to read off the safe load per square inch corresponding to that value of $l \div r$ indicated by the curve on the diagram.

Intentionally eccentric loads receive far too little attention, even from engineers, whilst it may be questioned whether they are considered in any definite manner by architects. When the loading is purposely eccentric, it is necessary to add the actual measured eccentricity, and the value of the term denoting the influence of sectional form, to the factors already included in the formula for "central" loads. Then the working formulas for mild steel columns of symmetrical section for the following values of accidental, equivalent, and measured eccentricity are:—

Total eccentricity = 2 in.

$$\frac{l}{r} = 10\sqrt{\frac{480}{12 - 3 fd}\left(\frac{2.4}{fd} - 3\right)}$$

Total eccentricity = 4 in.

$$\frac{l}{r} = 10\sqrt{\frac{480}{-12 fd}\left(\frac{2.4}{fd} - 5\right)}$$

Total eccentricity = 6 in.

$$\frac{l}{r} = 10\sqrt{\frac{480}{12 + fd}\left(\frac{2.4}{fd} - 7\right)}$$

Total eccentricity = 8 in.

$$\frac{l}{r} = 10\sqrt{\frac{480}{12 + 3 fd}\left(\frac{2.4}{fd} - 9\right)}$$

By the use of the formula in this manner it becomes a very simple matter to determine the exact effect of any purposely eccentric load on a column. Two or three experimental calculations will at once reveal the startling fact that in columns of ordinary proportions the strength may easily be reduced by 50 per cent. or more by a comparatively small amount of eccentricity of loading. In view of this fact our readers may well join us in wondering that the rules so extensively used for calculating column strength, and the handbooks so largely relied upon for information, should omit to provide for so serious an element of danger or to afford any hint as to its existence. Mr. Moncrieff's elucidation of the subject is therefore of the greatest value, and may suggest to some of our readers the advisability of inquiring whether columns designed merely to carry "central" loads may not sometimes have to withstand unjustifiable stresses by being unconsciously subjected to intentionally eccentric loads.

The last point considered by the author is the influence of side loads in addition to end loads upon columns. The effect of such loading is readily calculable, and the method to be followed is illustrated by Mr. Moncrieff in the form of a direct example, where the side load has the effect of reducing the safe end load by nearly 43 per cent. The proportion will of course vary in different cases, but it is very evident how important it is that accurate calculation should be made whenever a column has to support a load applied in this manner.

The valuable contribution to technical literature which we have briefly noticed is remarkable for the unique collection of diagrams presented, as well as for the lucid and simple demonstration of the theory propounded. Although much has been written in the past on the subject, and although many engineers have devised formulas for estimating the strength of columns, no effort previously made has resulted in a theory so completely covering the varied conditions encountered in practice, or so reasonably interpreting the results afforded by practical experiment.

NOTES.

Housing of the Working Classes. IT is quite clear from the debate in the House of Commons on the Housing of the Working Classes question that the Government do not propose any immediate or really any prospective legislation on the question. Dr. Macnamara moved an amendment to the Address, expressing his regret that the Government did not propose to bring forward any measure this Session. The debate which ensued last week went over the old familiar ground, points which have been frequently alluded to in our columns. Sir Dickson Poynder, in the course of the debate, again asked that the period of the repayment of the local loans should be extended. Mr. Long, President of the Local Government Board, in his reply, distinctly refused to entertain this proposal, and he, like the previous speakers, referred to many points which have been over and over again discussed. The whole of the debate was really a waste of time, since it had no practical result whatever, for it was purely of academic interest, and had no more practical value than a discussion at a debating Society. It is obvious that for any progress that may be made with regard to this question we must now depend for some time to come on the local bodies who are entrusted with the carrying out of this matter. It is to be hoped, therefore, that the Local Government Board will keep a strict eye upon the action of these Local Authorities, and will not fail to stimulate them in endeavours to improve the condition of the working classes. In regard to their houses, as we have often said, it is not so much new legislation which is required as the able carrying out of the powers now entrusted to the Local Authorities. We would again refer to the housing of the poor in the rural districts, and express our opinion that the Local Government Board should bring this question to the notice of every Council and every District Council in this kingdom.

Liverpool Cathedral. THE last incident in the Liverpool Cathedral discussion—or the last that has come under our notice—has been the publication in the Liverpool *Daily Post* of a letter from the Dean of Ely, who seems to be accepted by the Liverpool Press as an inspired prophet in architecture, though they will not listen to the opinions of the architects of their own city. The Dean of Ely is enthusiastic—he is even poetical—on the subject of the St. James's Mount site, but he objects to the north and south alignment of choir and nave. But what of that? It is easy enough, as he shows, to get over that difficulty; only make one of the short transepts, the eastern one, into the choir, and call the other short transept "the nave;" and then the long arm which should be the nave, and is in the usual architectural proportions of the nave, we will call a transept—and there you are! This ridiculous suggestion, which would destroy the whole architectural meaning of the mediæval type of plan, is solemnly proposed in a long letter in the journal referred to, and illustrated by a ground plan; and a Liverpool architect who wished to reply to it was refused permission to do so. Really the clerical party and the newspapers in Liverpool seem to be fairly off their heads on the subject.

Architectural Astronomers. SINCE the discovery of the fact that the axial position of many ancient temples was fixed by orientation in reference to the rise either of the sun or of some prominent star, astronomers and those interested in astronomy seem to have been unable to regard them in any other light than as astronomical instruments. Sir Norman Lockyer, in his book on the Egyptian temples, wanted to persuade us that all the architectural glory of these temples, erected

at an enormous cost, was only for the purpose of observing the day on which the sun rose on the axial line of the temple; and at the Institute of Architects he informed his audience, in the same spirit, that Stonehenge was a temple for observing the length of the year by recording the rising of the sun on the longest day in the year, and that "such temples were erected in the very first blush of civilisation in order that the people should be able to fix the time for performing agricultural operations." Even if primitive man were more stupid than the birds and beasts, and had no sense in himself of the change from winter to spring, and from cold to warm weather, a set of stakes set up would have answered the purpose of observing the sunrise just as well as these enormous stones—or better; and we are disposed to think that prehistoric men had more common sense than some modern *savants*.

Building Contracts.

THERE never could have been any doubt as to the decision to be given in the case of Hobbs *v.* Turner, which was decided by the Court of Appeal last week. It is, however, desirable to refer to it, because of some expressions in the judgment of the Master of the Rolls. The case itself was really a simple one. It arose out of a contract for the erection and completion of a house, and the defendant was the building owner. The contract was in the usual form of the Royal Institute, and contained a clause in regard to provisional sums for work to be performed by special artists or tradesmen. The specification contained the following clause:—"Provide and fix iron balcony railings to design, allow 20*l.* for this, irrespective of carriage, fixing, and profit." The architect selected the plaintiff to supply the ironwork for the balconies, and the builder asked him to send designs to the architect. After the goods were supplied and sent to the builder, the account was sent to him, but subsequently he was told by the architect that the amount should be certified direct to the building owner. The amount itself was only 27*l.* 10s., but this the defendant refused to pay, and when the case came before Mr. Justice Kennedy, judgment was given for the plaintiff. It is difficult to see why the defendant should have supposed he was not liable to pay this sum, and it is not surprising, therefore, that the Court of Appeal gave judgment against him, Lord Justice Matthew remarking that the question was one simply of fact. But in the course of his judgment the Master of the Rolls laid down something in the nature of a principle—namely, that the proper inference to draw from this form of contract was that it was intended that the building owner and not the builder should be the principal, and that the builder, in ordering the work in question, acted as agent to the building owner. It was quite possible for the builder to make himself personally liable to the supplyer of the article if he distinctly stated that he and not the building owner was the principal in the transaction. Every decision on a case of this character must generally depend on the special form of the contract; but we think it may be taken as the result of this decision that in all cases under the form of the Royal Institute a builder, when he orders a special article, does not make himself personally liable, and that the building owner is responsible for the payment. If this be so, this case certainly is a valuable commentary and explanation on this well known form of contract.

The Widening of Piccadilly.

AT the end of last week the works for widening the western end of Piccadilly between Hyde Park Corner and Down-street were begun. The alteration involves the setting back of the Green Park railing, which extended in a curve from the Arch at Constitution Hill to a point opposite Hamilton-place, straightening the curve, and taking from the park (and from the parish of St. Martin-in-the-Fields) a further strip of land measuring 35 ft. wide at its broadest part. The alteration will be completed in the course of the spring, at an estimated cost of 13,536*l.*, as agreed to by the London Connty Council at their meeting on November 26 last. The railings are to be rebuilt upon a foundation of concrete, and the Piccadilly pathway is to be relaid, in York paving, to a width of 14 ft. We have already commented upon the futility of the scheme, which cannot possibly remedy an evil arising from the block that is due to the crossing traffic north and south, and which, in effect, will but enlarge the extent of the existing area of obstruction. The hindrance is in fact occasioned by the unrelieved endeavours of two lines of traffic to cross one another upon one and the same level, and not by the actual amount of the traffic itself. The traffic demands better direction, and upon two different planes, rather than wider space, for its course.

The Plumbing Trade.

THE Plumbers' Company have drawn up a set of conditions of indenture for apprentices in the plumbing trade, which seems calculated to put education in plumbing on a satisfactory basis. The term is for five years, if apprenticed in London; and the apprentice is bound to learn the trade of a plumber and the art of sanitary plumbing, including all branches of the said trade which require technical knowledge of water fittings and other sanitary appliances, and skill to construct and adjust them so as to prevent the contamination of air or water in dwelling-houses or other buildings by emanations from drains or sewers. He is also to attend the evening classes of such technical institution or trade school as the Master may direct, with the approval of the Plumbers' Apprenticeship Board; and in every year after the first year he is to submit himself for examination in technical knowledge of the trade and in workmanship, in conformity with regulations prescribed by the Plumbers' Apprenticeship Board, acting in conjunction with the Plumbers' Company.

Leakage Electric Currents.

THE paper read by Mr. Wedmore to the Institution of Electrical Engineers this week on "Earth Currents Derived from Distributing Systems" is an able one, whether regarded from the mathematical or the electrical point of view. The author appears to have been one of the earliest to realise that the magnetic disturbances caused by leakage currents from tramway systems give a fairly accurate indication of the magnitude of these currents. He proves that if the whole current returns by the rails, then the magnetic effects would be practically zero, except in the immediate neighbourhood of the rails. It is notorious, however, that the work of magnetic observatories is rendered useless when an electric tramway is laid within a few miles of them, and hence the leakage currents through the earth must be considerable. He quotes a case where from the magnetic data given he calculates the leakage earth current to be 60 amperes—a result which agrees with direct measurements made on electric systems. He considers that the electrolytic damage done by these leakage currents has been grossly exaggerated. We think that it is too early yet to say whether it has or not. It will be extraordinary if these huge leakage currents do not after a few years "eat" away portions of the gas and water mains near the tram lines. We are sorry that Mr. Wedmore barely touched on the leakage currents from lighting systems, as in our opinion they are quite as important and far more insidious than the currents from tramway systems. We are glad he exposed the fallacy of making the pipes in the neighbourhood of the rail negative to the earth. The effect of doing this is to increase the current flowing in the pipes, and as it makes a circuit in the earth round each bad joint, the damage to the pipes will obviously be increased.

Electric Lighting Explosions in the City.

SOME very interesting and instructive evidence was given in the Board of Trade Inquiry last week as to the cause of the explosions in the mains of the Charing Cross and Strand and of the City of London Electric Lighting Companies, which occurred on the 4th and 5th of this month. Several police-constables described the effects of the explosions in the cable vaults, and how the covers of two manholes were forced off and blown into the air. The explosions were caused by the highly inflammable gas given off by the bitumen, in which the cables are laid in the solid system, becoming ignited in one case by a short circuit to earth, in another by a jointer striking a match in the box, and in a third by lowering a lamp into a manhole. No one was seriously hurt, but several of the employés of the Strand Company were overcome by the poisonous fumes from the bituminous gas and had to be taken to the hospital. These accidents prove that there are drawbacks to using an inflammable substance like bitumen, although it is excellent from an electrical and mechanical point of view in which to lay the mains. The evidence completely bears out what we stated last year about the dangers of three-wire direct-current systems when they become very large. The mains superintendent of the City Company said that the Charing Cross Company had interrupted their mains sixty-five times last year and the Post Office underground wires twenty-five times. He mentioned the case of a perfumer's shop in Cheapside, where he found the insulation running off the main owing to an earth current, which almost certainly must have come from the Charing Cross and Strand Company's mains. Those who have inspected the methods of working of direct current stations are familiar with the rough-and-ready methods in vogue of testing for faults. As was stated in evidence, the first suspicion of anything being wrong was the fact that an ammeter was "hard over." This means that thou-

sands of amperes are burning out a fault or are straying among the buried pipes of the City. We know that this experience does not occur infrequently amongst other direct current companies. We are told that the Strand Company works with a constant "earth" test, but the infinitesimal value of this test is shown by Mr. Wordingham's evidence, and is proved in a communication last year by Mr. Russell to the Institution of Electrical Engineers. As we have stated before, when direct current networks become very large, trouble will ensue, and the companies will be well advised to attack the problem of raising the insulation resistance of their whole system before taking on new consumers.

The Welsbach Incandescent Gaslight Co.

FOR a long time past the exorbitant charge of 7½d. (formerly 1s.) per mantle has been made for Welsbach mantles sold in this country, although mantles of equally good quality have, during the same period, been sold on the Continent for 3d. or less. A very extensive business has been carried on by the English company, which, however, has not proved profitable to the shareholders. By an overwhelming majority the shareholders have now decided to get rid of the present board of directors, and to replace it with a board which will carry on the business upon new lines. It is proposed to write down the capital, which was notoriously excessive, and to reduce the annual expenditure on litigation. A closer connexion will also be made with the gas companies. If the English company is not committed to the purchase of materials from the Austrian company at prices above their market value, there is every reason to believe that with the proposed reforms, including a large reduction in the selling price of mantles, the English company may be converted into a paying concern. In this country about 20 per cent. of the gas-burners in use are incandescent burners, compared with 90 per cent. in some Continental towns. With the advent of cheap mantles there is no doubt that the proportion of incandescent burners employed will increase rapidly, and that the number of mantles required for renewals and for replacing flat flames will necessitate a large increase in the rate of manufacture.

The Architect's Use of Enamelled Tiles.

ON Tuesday evening Mr. Halsey Ricardo gave a lecture at the Society of Arts on the use of enamelled tiles in architecture; a lecture delightful to listen to, and illustrated by a perfect wealth of lantern slides of tile-decorated buildings, chiefly of course Eastern; and though colour was unfortunately wanting, the illustrations at all events stimulated one's colour imagination. Whether this type of architectural decoration will ever be introduced largely in northern cities, as Mr. Ricardo wishes to see it, is rather doubtful. Colour, and the desire for it, go with regions of strong sunshine; it may seem curious that it should be so, and that those living in a dull atmosphere should not rather strive after colour to frighten their buildings; but somehow strong colour seems to lose its effect and to be out of place under dull skies, and we are rather inclined to think that this is an inherent feeling which will not be reasoned down. Nor do we much like the idea of a city architecture of glazed surfaces. Can we not have permanent and washable coloured material without glaze?

The Two Churches at Swaffham.

THE quarterly issue of the *Church Builder* draws attention to the condition of the two churches, that of St. Mary and that of SS. Cyriac and Julitta, which stand close together at Swaffham in Cambridgeshire, sometimes named on this account "Swaffham Two-churches." There were originally two parishes, subsequently consolidated into one. The tower of St. Mary, now half demolished, is or was an octagon on a square ground story, and with a sixteen-sided story and a spire above this; the other tower is square for half its height, but finishes as an octagon. The effect of the two when complete, standing close together, must have been very unusual and picturesque. St. Mary's spire was struck by lightning (the date of the event is not given), a disaster which seems to have been thought at the time a sufficient reason for deserting the church and destroying both buildings. The demolition of St. Mary's, however, was found to be "too great an undertaking," though it was thrown into ruin, and the nave of SS. Cyriac and Julitta was pulled down and eventually a "churchwarden" nave built in its place. This is now to be removed, and the tower left as a campanile, while St. Mary's is in course of restoration for worship, under the care of Sir A. Blomfield & Sons.

The Beaufort Estates, Monmouthshire.

IN the course of next spring a further portion of the Duke of Beaufort's property, including Grosmont, Striguil, and White Castles, and Wentwood (some 2,200 acres of woodland), will be offered for sale. Last autumn the Government purchased, from the estates, a tract of land of 8,500 acres lying between Monmouth and Wynd Cliff, near Chepstow, and adjoining the Forest of Dean, and thus secured the ruins of Tintern Abbey, together with Monmouth Castle. Usk Castle has been bought privately, whilst the Duke will, it is stated, retain Raglan Castle. Up to the close of last year a total area of 23,470 acres was disposed of, with the timber, for 626,000*l.* Grosmont has been identified with Rosslyn Castle, or Rossllwyn, the Castle of the Red Rose, a residence of the Earls and Dukes of Lancaster. White, or rather Llanteilo, Castle, seven miles north from Monmouth, is supposed to have been built *temp.* Stephen, and, together with Grosmont and Skenfrith, was dismantled by order of Edward IV. Chepstow has been identified with the Estrighoiel—since Striguil—of the Domesday Survey, as standing by the Roman *Strata Julia* at its crossing of the Wye, and is one of the largest and most important of the many castles in the Marches. Whilst the fabric presents traces of Roman masonry, it is generally considered that the fortress was established by William Fitz-Osbern, whose son Roger forfeited it in 1078 for rebellion against the King, who bestowed the lordship of Striguil upon the de Clares. Walter de Clare, who founded Tintern in 1131 for some monks from L'Aumone, had acquired all Nether-Gwent, or Monmouthshire, under a licence from the King to become over-lord of whatever lands he wrested from the Welsh. His lands passed to his nephew, Gilbert Fitzgilbert, surnamed Strongbow, whom King Stephen created Earl of Pembroke in 1138. His son Richard Strongbow, had an only child, Isabel, who married William, Earl of Pembroke, whose monument is in the Temple Church, London. Their eldest daughter, Maud, brought Striguil in marriage to Hugh Bigod, Earl of Norfolk, whose descendant, Roger, rebuilt Tintern in 1269. The Bigod lands ultimately devolved upon Sir Charles Somerset, elevated Earl of Worcester in 1514, and ancestor of the ducal house of Beaufort, when he married Elizabeth, daughter and heir of William, Earl of Huntingdon, son of the renowned William, Lord Herbert of Raglan, Chepstow, and Gower, advanced Earl of Pembroke in 1468. The ruins, entered through the great gate-house flanked with two drum-towers of Edward I.'s day, consist of four wards, ranged upon the slope of a lofty limestone rock, guarded by the Wye on the north, and a deep moat. The kitchen, offices, and lesser hall (*temp.* Edward II.), with the tower named after Marten the regicide, in which is the lord's oratory, a beautiful thirteenth-century chamber, are in the first court or lower ward; in the middle ward is the Norman keep, containing much work of the Early English period.

Lecture Diagrams.

WE should like to draw the attention of those who read papers before the Institute of architects, the Architectural Association, and at other similar gatherings, to the importance of having wall diagrams, if necessary for the elucidation of the paper, so drawn that they can really be visible and intelligible to the audience from their seats. Nothing can be more absurd than for a reader of a paper to be constantly referring to diagrams on the walls, and saying "as shown on Sheet A" and so on, when the drawings are really such that no one can see them; but this is a constant experience both at the Institute and at the Association. It is true, a lecturer may line the walls with extra illustrations to give people something further to look at afterwards; but those which he actually uses for reference in the body of the paper ought to be drawn so as to be visible to the audience, otherwise the whole thing is a mockery. Some people seem to think it is quite sufficient to have an illustration on the walls and refer to it, whether their listeners can see it or not. This shows a want of trouble in preparing a paper, and to our thinking a want of respect for their audience. Architects should take example from the way these things are done at the Institution of Civil Engineers. The walls are often covered with diagrams there, but they are always drawn in such a way that every one in the hall can see them.

DISTRICT SURVEYORS' ASSOCIATION.—Mr. Benjamin Tabberer, having served the usual term as President of the London District Surveyors' Association to the great satisfaction of the members, has retired, and the following have been elected as office bearers for the year 1902:—President, Mr. Alfred Williams; Vice-President, Mr. Alex. Payne; Hon. Treasurer, Mr. Henry Lovegrove; Hon. Secretary, Mr. Fred. Waller; and eighteen members forming the Committee.

APPOINTMENT OF SANITARY OFFICERS.—The Local Government Board has sanctioned the appointment of the following Sanitary Officers:—Mr. G. T. Billing, Sanitary Inspector in Finsbury; Mr. H. Wilkinson, Sanitary Inspector in Islington; Messrs. A. Taylor, J. W. Whipp, and F. A. Aris, Sanitary Inspectors in Westminster.

THE ROYAL INSTITUTE OF BRITISH ARCHITECTS.

A MEETING of the Royal Institute of British Architects was held on Monday at No. 9, Conduit-street, Regent-street, W., Mr. J. Slater, vice-President, occupying the chair.

Mr. Alex. Graham, hon. Secretary, announced with regret the death of Mr. J. L. Hodgson, Associate, who practised as an architect at Lille, France. He also announced the receipt of 5*l.* 5s. from Mr. Sydney Smirk towards the Library Fund, and said that Mr. Smirk had annually contributed that sum for some years, and they would all agree that a vote of thanks was due to this gentleman.

Prizes and Studentships.

The motion having been agreed to,

Mr. Locke, the Secretary, proceeded to read the Deed of Award of Prizes and Studentships for 1901-1902 :—

The Essay Medal and Twenty-five Guineas.—Four essays on the Employment of the Order in Renaissance and Modern Architecture were received for the Silver Medal. The Council regret that they are unable to award the Medal, but they have voted the sum of ten guineas to the author of the essay bearing the motto "Serlio" (Mr. J. J. Waddell).

The Measured Drawings Medal and 10*l.* 10s.—Twelve sets of drawings were sent in, of the several buildings indicated, and under motto, as follows :—1. Ace (Eltham Palace, Eltham, Kent). 2. Aidan (Lindisfarne Priory). 3. Cavendo Tutus (Bolsover Castle). 4. Inca (Houghton Hall, Norfolk). 5. La Oriole (Oriel College, Oxford). 6. Peakite (Bolsover Castle Riding School). 7. Scheherazade (King Henry's Gate, St. Bartholomew's Hospital). 8. Semper Fidelis (Guildhall, Exeter). 9. Strand (St. Mary-le-Strand Church). 10. "Wren" (Emmanuel College Chapel, Cambridge). 11. H in circle (Aston Hall, Warwickshire). 12. Device of Two Lozenges (St. George's Church, Bloomsbury).

The Council have awarded the Silver Medal and Ten Guineas to the delineator of Bolsover Castle, submitted under the motto of "Cavendo Tutus" (Mr. F. W. C. Gregory, Nottingham), and prizes of Five Guineas each to the delineators of Lindisfarne Priory, Houghton Hall, and Aston Hall, Warwickshire, submitted under the respective mottoes of "Aidan" (Mr. R. W. Owen, Liverpool); "Inca" (Mr. S. Towse, Catford), and "H in circle" (Mr. E. F. Reynolds, Notting Hill Gate, W.).

The Soane Medallion and 100*l.*—Sixteen designs for a swimming bath for men were submitted, under the following mottoes :—1. Amphibious ; 2, Balneæ ; 3, Faust ; 4, Hero ; 5, Io ; 6, Iona ; 7, Naiad ; 8, Natator ; 9, Nero ; 10, Phœnix ; 11, Roma ; 12, Silhouette ; 13, Tepidarium ; 14, Ursa Major ; 15, Wyvenhoe ; 16, Zeno.

The Council have awarded the Medallion and (subject to conditions) the sum of 100*l.* to the author of the design bearing the motto of "Iona" (Mr. J. B. Fulton, Glasgow); Medals of Merit to the authors of the designs bearing the mottoes respectively of "Balneæ" (Mr. L. G. Detmar, Sutton) and "Tepidarium" (Mr. Thomas A. Moodie, London); and a Certificate of Hon. Mention to the author of the design bearing the motto "Io" (Mr. E. Vincent Harris, London).

The Owen Jones Studentship and 100*l.*—Seven applications were received for the Owen Jones Studentship from the following gentlemen :—1. Edward H. Bennett ; 2. Cecil Scott Burgess ; 3. V. J. Cummings ; 4. L. Rome Guthrie ; 5. James McLachlan ; 6. Percy E. Nobbs ; 7. Ramsay Traquair.

The Council have awarded the Certificate and the sum of 100*l.* to Mr. Edward H. Bennett, Paris ; a prize of 10*l.* 10s. to Mr. Percy Erskine Nobbs, M.A.Edin., Chelsea ; and a prize of 5*l.* 5s. to Mr. James McLachlan, Edinburgh.

The Pugin Studentship and 40*l.*—Twelve applications were received for the Pugin Studentship from the following gentlemen :—1. George A. Bachmann ; 2. Heaton Comyn ; 3. P. Ion Elton ; 4. J. W. Farmer ; 5 J. Harold Gibbons ; 6. W. S. A. Gordon ; 7. Stanley H. Hamp ; 8. A. Muir ; 9. J. B. Pye ; 10. J. Myrtle Smith ; 11. C. Wontner Smith ; 12. P. J. Westwood.

The Council have awarded the Medal and a sum of 40*l.* to Mr. Cyril Wontner Smith, Finchley ; Prizes of Five Guineas each to Mr. Andrew Muir, Hammersmith, and Mr. J. Myrtle Smith, London ; and a Certificate of Honourable Mention to Mr. J. H. Gibbons, Manchester.

The Godwin Medal and 40*l.*—Two applications were received for the Godwin Bursary from the following gentlemen :—

1. Henry L. Merille de Colleville.
2. Charles A. Daubney.

The Council have awarded the medal and the sum of 40*l.* to Mr. C. A. Daubney, Peckham.

The Tite Certificate and 30*l.*—Twenty-four designs for a Royal Memorial Chapel in the Italian style were submitted under the following mottoes :—1. "Archivolt" ; 2. Avanti Savoia ; 3. Bramante da Urbino ; 4. "Duomo" ; 5. Gibbs ; 6. Issius ; 7. "In Memoriam" ; 8. "John-o'-Gaunt" ; 9. Lion Heart ; 10. Marble ; 11. Moab ; 12. Nero ; 13. Nimrod ; 14. "Pax" ; 15. Petronius ; 16. Rex on grey strainers ; 17. Rex on brown strainers ; 18. R.I.P. on 3 strainers ; 19. R.I.P. on 5 strainers ; 20. Tendimus ; 21. Device of a Shamrock ; 22. Device of a Circle ; 23. Device of a Blue Cross ; 24. Device of 3 Red Seals.

The Council have awarded the Certificate, and a sum of 30*l.* to the author of the design bearing the motto "Lion Heart" (Mr. C. Gascoyne, Nottingham) ; a Medal of Merit to the author of the design bearing the motto "In Memoriam" (Mr. Andrew Hutton, Dundee), and a Certificate of Honourable Mention to the authors of the designs bearing the mottoes "Marble" (Mr. W. Curtis Green, London) ; "Rex on Grey Strainers" (Mr. Arthur R. Gough, Bristol) ; and "Shamrock" (Mr. C. E. Power, London).

The Grissell Medal and 10*l.* 10s.—Six designs for a Timber Footbridge across a Stream were submitted under following mottoes :—1, Cædmon ; 2, Groined Barrel ; 3, Hertford ; 4, Rover ; 5, Toby ; 6, Red Trefoil.

The Council have awarded the Medal and 10*l.* 10s. to the author of the design bearing the motto "Toby" (Mr. L. Upperton Grace, Regent's Park).

The Ashpitel Prize, 1901.—The Council have, on the recommendation of the Board of Examiners (Architecture), awarded the Ashpitel Prize (which is a prize of books value 10*l.*, awarded to the candidate who has most highly distinguished himself among the candidates in the Final Examinations of the year) to Mr. C. Thomas Adshead, of Liverpool.

The Council have further awarded a prize of books to the value of 10*l.* to Mr. Frederick Dare Clapham, in recognition of the merit displayed by him in his work at the Special Examination, June, 1901.

The Travelling Students' Work.

Owen Jones Studentship, 1900.—The Council have approved the drawings and design executed by Mr. George Andrew Paterson, who was awarded the Owen Jones Studentship for 1900, and who travelled in France, Italy, and Spain.

Godwin Bursary, 1900.—The Council have approved the Report of Mr. Sidney Kyffin Greenslade, who was awarded the Godwin Bursary in 1900, and who visited the United States of America to study the Planning and Construction of Public Libraries. The Council have awarded Mr. Greenslade an extra grant of 20*l.* to enable him to continue his studies.

Pugin Studentship, 1901.—The Council have approved the work of Mr. Henry William Cotman, who was elected Pugin Student for 1901, and who travelled in Wiltshire, Somersetshire, Dorsetshire, Gloucestershire, Warwickshire, and Oxfordshire.

Stonehenge.

Mr. Detmar J. Blow then read a paper on "The Architectural Discoveries of 1901 at Stonehenge," and first dealt with the archæological investigations of the place in 1600 by one of the greatest masters of our art, although without any really satisfactory result. He meant the investigation by Inigo Jones, whose valuable "Discourse on Stonehenge Restored" was drawn up by direction of King James I. in the year 1620. After much reasoning, and quoting a long series of authorities, Inigo Jones concluded that at least this ancient and stupendous pile must have been originally a Roman temple inscribed to Cœlus, the senior of the heathen gods, and built after the Tuscan order. This notion was, however, warmly attacked by Dr. Walter Charleton in the treatise called "Chorea Gigantuam," which was published in 1663, and in this the Doctor is very positive that this extraordinary monument was erected by the Danes, and he caused a copy of Inigo Jones's discourse to be transmitted to Oleus Wormus, the celebrated antiquary of Denmark. From the argument which followed, the Doctor drew up his treatise, in which he mentions that this "ruinous fabric" was in reality of Danish origin. The world, however, did not generally come to the Doctor's sentiments, although Sir W. Dugdale is said to have approved of them, and Mr. Dryden wrote an eloquent panegyric to the author upon his performance. This raised a controversy, and gave occasion to Mr. J. Webb, to whom we owe the original publication of Inigo Jones, to give what he calls a "Vindication of the Stonehenge Mystery." Mr. Samus, in his "Britannica," had it that Stonehenge was Phœnecian, and Mr. Aubrey thinks it was British ; and yet, if the true writing of the name be "Stanhengest," Bishop Nicholson says he could not see why the Saxons might not have as just a title as any to the honour of it. Mr. Stukely says that if Stonehenge was of Roman work, it would certainly have been built at the Roman scale, and had Inigo Jones reduced his own measures to that standard, he would have seen the absurdity of his opinion. When Stukely examined the dimensions of Stonehenge he found, as he surmised, that they are all fractions in the Roman scale—undoubted evidence that the Romans had no hand in building it. Stukely says they are stones of different diameters upon elevated ground, and are generally stones taken from the surface of the ground. The monument has stood there and seen the rise and fall of more than one civilisation—sometimes the object of archæological inquiry, and at other times lost and forgotten, for in the Roman occupation it is not recorded. The great monolith called the leaning stone was the largest in England, Cleopatra's needle excepted. It was one of the pillars of the highest trilithon, and stood behind the altar stone, near which it leaned at an angle of 65 degs. Half way up it had a fracture one-third across it, and the weight of stone above that fracture was a dangerous strain upon it. It had now been brought to a vertical position. One Roman coin and one George III. were found quite near the surface. Numerous chippings of the sarsen and blue stone, of which Stonehenge was built, were discovered. The flints found were used for the softer sarsen and blue stones, and the hand hammers and mauls for rough dressing. From this the deduction had been made that the building belonged to the Palæolithic period. All authorities agreed that it was the work of a highly-civilised people. The construction was one of a stone development, and the surface of the stone was finished much like that of granite. The design of the pillars was, in his opinion, evolved from the shapes of the flint instruments used by the workman, to which his hand had grown accustomed. Each pillar had a bold entasis in its elevation and in its plan foreshadowed the column. With the aid of the illustrations he described the method of raising the leaning stone and the sifting process, the articles found being afterwards shown to the audience. Stonehenge having been generally supposed to be of the bronze age, it was with great joy that he lighted upon the stone implements. It was, he believed, the only occasion on which the implements were found actually next to the stone building where they were used. The British Association had formed a committee for investigating the stone circles over the country. Excavations are being made at Aberlow, and it is possible it may be found to be only rougher monuments earlier or later to the Stonehenge period.

The Chairman said he was sure they had listened with great interest to the description which Mr. Blow had given of the way in which the stone was raised up, for there was no possible way of showing it so well as by the illustrations they had had. He had rather hoped they would have had a little more information about Stonehenge itself, but perhaps they would get it from some of the gentlemen there that night, who, he knew, had paid great attention to the subject. He would ask Sir Norman Lockyer, who had made a great study of the subject, to say something about it.

Sir Norman Lockyer said he need not say how extremely important these researches which Mr. Blow had described were to any one who studied Stonehenge, and any ancient monuments which might be approximately of the age of Stonehenge, for the reason that he believed that archæologists had quite come to the conclusion that from the evidence which

had been obtained alone by the means which Mr. Blow had brought before them, they were justified in assuming that the sarsen slabs were erected in Paleolithic times—that was to say, before the age of bronze, or, at all events, before bronze had been used for any ordinary kind of work in that part of England. While this work had been going on—in fact, slightly before the work was commenced, Mr. Penrose and himself had been occupying themselves with Stonehenge from a slightly different point of view. They were very anxious, if possible, to determine its age, because very much depended upon it. First of all, Stonehenge was an ancient stone, but lent itself better to astronomical work than Aberlow, Stanton Drew, and the stone circles near Keswick and in other parts of England. It was much more difficult to get certain data from these ancient monuments than in the case of Stonehenge, for the reason that Stonehenge itself was on high ground, and the horizon around it in all directions is brought nearly to the same height. This was important from an astronomical point of view, and the task of observation was made quite simple at Stonehenge; and if it was necessary to find the point of time it would be more easy to do it than by tackling any of the other ancient monuments to which he had referred. In orientation generally, as they had dealt with it in Egypt and Greece, the question was the change of position—in the axis of the temple or the laying down of the axis of the temple or a church by means of observations of stars. But, fortunately for them, as archæologists and not as astronomers, the movements of these stars were very considerable, so that if a temple was pointed to a star one year, in 200 or 300 years it no longer pointed to the same star, but to another one. That, of course, applied to temples the erection of which had been determined in the first instance by observations of stars, but that, unfortunately, could not apply to Stonehenge, because it had been well understood, and acted upon ever since they could remember, that the people of Salisbury and the surrounding places went to observe the sun rise on the longest day of the year at Stonehenge, and they were justified in assuming that it was a temple used for the observation of the height of midsummer. Some other principle than stars had to be adopted, and that was to point the temple directly to the point of the horizon at which the sun rose on that particular day of the year and no other. And here a very important point came in—it was the point of the year; the day of the year most easy to take by astronomical observation, because all they had to do was to observe the sun climb the sky at noon and set more and more north as summer came along until at the height of summer they had the extreme north-easterly point of the horizon reached and the sun stands still. All they had to do was to put a lot of sticks up, and they had their line, and even after that they would find that the sun came back to the same place. When they had once got their alignment for the rise of the sun, they could determine absolutely the length of the year and the beginning of each year as it came along. Now if there were no change in the position of the sun, of course that would go on for ever and ever, but fortunately for archæologists there was a slight change in the position of the sun—the planes of the ecliptic and the planes of the equator having a slight change in the angle between them. So far as they knew it had been gradually reducing this angle for many thousands of years, and so in the case of Stonehenge, if one wished to determine the date one had no stars to help one, and the only thing one could hope to get any information from whatever was the very slight change of this angle between the plane of the ecliptic and the plane of the equator; and that was the special point which Mr. Penrose and himself set out to do at Stonehenge, because, for the reasons he had already set out, they considered they were in a position to do it more conveniently from there than anywhere else in the country. Well, they made their observations and came to the conclusion that the avenue which was associated with the sarsen stones was laid down about the year 1680 B.C. They considered that it was impossible to fix the date nearer than 200 years, for the reason that the change to which he had referred in the ecliptic varied very slightly. Their ancestors—he supposed they were their ancestors—who were engaged in the erection of these works had been very much misrepresented and were held to be entirely in the wrong by some people who had not found out what they were really driving at. It was absolutely essential for the inhabitants of Britain as it was then, townless and almost uncivilised, that they should know something about the proper time for performing their agricultural operations. Now they could go into shops and buy an almanack which would give them everything they wanted to know about the year and month and the day, and that was the reason why so few cared about astronomy. But these poor people in those days, unless they found out the time of the year and the month, had absolutely no means of knowing when their various agricultural operations should take place, and so they found all over the world such temples as Stonehenge were erected in the very first blush of civilisation in every part of the world they enquired into. On that a point came in of very considerable interest, with special reference to Stonehenge. If they took the civilisation of Egypt, they found, as far as they knew, that the first people who used this principle of orientation for agricultural purposes were some tribe or other who came down the Nile 7,000 years B.C. After that they found the next race, instead of being interested in sowing and therefore interested in agriculture, were interested in the year about the time of Easter, which was the August festival of a large part of Egypt. This race built the Pyramids 4,000 years B.C. Then came another race which started Solstitial worship—the worship of the sun at midsummer. They must not forget that not long before that farmers tried to sow by the moon. Not only was that method employed for centuries, but it fixed the unit of time even of human life, and they knew now that when men were said to have lived their 1,200 years, it meant 1,200 months. When they looked back in the history of their own country and came to Britain—leaving alone Greece and Rome—they found that at various times in their country they had the farmers' year beginning in the month of May, another farmers' year beginning in the month of August, and another year beginning at the longest day, and it appeared that the year which began at the longest day was really the last one to be introduced. So they would see that although Mr. Penrose and himself had been able to show, he thought, beyond all doubt that they had in Stonehenge a Solstitian temple for observing the length of the year by observing the rise of the sun on the longest day of the year, yet in other parts of England there were other temples for observing the sun, not on June 21, but early in May and early in August, and it was quite possible at some future time, when Mr. Penrose and himself considered other stones, they might find that Stonehenge had something to tell them on that point also.

Mr. F. C. Penrose said he observed that the avenue at Stonehenge, which gave them a clue, was exactly a counterpart to the line of sphinxes which led to many of the Egyptian temples. It was impossible to consider the matter of Stonehenge without having extreme veneration for the monument, and he was rejoiced that so much attention was now being paid to it, and that the repair of the temple had been begun in a sound and legitimate sense by raising the leaning stone from a position of danger. Perhaps they might hope that the trilithon which fell down about a year ago might be put back into its position. He gathered from Mr. Gowland, that he derived from the appearance of the tools, that about 200 years B.C. was about the probable date, and that was within their estimate. They had many tools in the room that night, and they would notice that many of them had been worn with the work. He would like to ask just one question. He understood that fragments both of sarsen and blue stone were found in the excavations. He would like to know whether the chippings of sarsen were in much greater abundance than those of the blue stone.

Mr. Blow: I think that was the case.

Mr. Penrose said it was possible that the blue stones might have been altered in their position when the sarsen stones were put up, although it was by no means certain that that was so. The quantity of the chippings of the two materials might have some bearing on the question.

Mr. Emmanuel Green remarked that very much had been said, and Sir Norman Lockyer and Mr. Penrose had come forward with their theories, and probably they might be right, but, without any offence, he hoped they would not allow their authority to influence their opinions too much and prevent further investigation. There was no doubt that local men went round on June 21, and that the sun came upon that morning where they expected it to come, and following that matter, they might follow up the matter of ordinary worship. There was a little point which had not been mentioned. No doubt the idea arose when the sun almanack started, but it had not been noted that there were thirty stones in the outer circle at Stonehenge, and they would see that if services were held at the different stones every day of the month they would get their month each time they went round the circle. There was a thirty-first stone by which the thing was made to tally and come right. The attitude for the archæologist, he thought, was that if they found something of which they did not know its use, they asked themselves the question whether there was not a thing exactly like it elsewhere, and if they found it was so they at once concluded they had something which in its turn served that same purpose. It was a rather curious thing that in the book, "The Earl and the Doctor," the late Earl of Pembroke noticed very plainly and clearly a similar kind of thing in the Pacific islands. He noticed that when a man got old and dirty and poor he set himself up as a priest, retired to a hut on high ground, and got stones set up exactly as at Stonehenge, and there he sat to receive cowrie shells from those who went to him. That was a remarkable and curious thing, but there was another thing connected with it which had never been noticed in Stonehenge—that the spaces between the stones were filled up with rubble. In the case of Stonehenge that was gone. There were in Scotland to-day still buildings where there were large stones for the uprights and doors and sills, and the spaces between were filled up with rubble. That was a little point which had not been noticed. Then on the question of moving the stones, the plan shown of the way it was done in Japan was, no doubt, an early one; but in India they could see to-day large stones moved in a manner which would recommend itself very much to them. The stone was placed on rollers such as they would see being used for moving an iron safe into a house. Some 200 men were harnessed to the stone, and the rollers were placed in front and the stone moved slowly along. Another thing they would like to hear something about was as to where the stones at Stonehenge came from. It was a question of geology, and the investigations of local men were such that they might fairly consider that the stones were there. There were Sarsen stones there to-day, and Sarsen stone was being broken up to-day. As to how they were deposited there, that they must leave to geologists to determine. It had always been an enormous puzzle how they were erected, and he thought that still wanted a little investigation. On the top of the columns there was a tenon, and the stone laid across was hollowed, and it was very difficult to understand how that was done. The stone and flint business did not at all explain that. He thought that with regard to the question of the date, they must await a little further investigation. Mr. Storey Maskelyne had given great attention to this thing, and worked very hard on it, and had given his figures and all his reasons, as a good scientific man always did, and he concluded that the date was 2900 B.C. They got here a difference of 1000 years, and yet the arguments given were equally clear and equally apparent, and under those circumstances the more evidence they got and the more arguments they obtained, and the more attention which would consequently be given to the subject would possibly tend by degrees to get rid of what was not true and gradually reduce the range of time.

Mr. St. John Hope said he could not claim to have made the question a study, but he had been struck with a astonishment at the stupendous character of the work itself and wondered how it was made, and he would like to ask a number of questions. He had tried to get an answer to those questions by reading a great deal of the vast quantity of matter which had been written round about Stonehenge, but there were so many theories put forward by different writers that one left off in the same state of not knowing anything with which one started. The investigations which had just been made at Stonehenge had shown the enormous value of investigations by means of pick and spade.

For a very long period men had been wasting time and their brains in putting forth their theories on paper, all to no purpose; but here in one little excavation within a short space of time a very great deal had been set absolutely at rest. To begin with, it was quite clear from the materials which had been brought to them that night, that they could get some indication as to date. He was sorry Mr. Gowland was not there to tell all the little details about the discoveries of the things which had been shown and the facts which he had adduced from them; but as regarded the date, Mr. Gowland argued that there could be no doubt whatever that these various tools, both the small hammers and the flint instruments used for dressing the harder stones, belonged to the period of transition from the Stone Age to the Bronze Age. Mr. Gowland did not dispute, so far as he could learn, the fact that this monument might even belong to the early Bronze Age; but he said they could satisfactorily account for the absence of bronze tools, for the simple reason that bronze tools would be absolutely useless to work the stone of Stonehenge. It would have no effect on sarsen and the still harder blue stone, although it was possible that further investigations might bring to light some bronze things which had been dropped and tools which had been used in building Stonehenge. They would see what a very small area had already been attacked in the way of scientific excavation, and if that very small area brought to light so much, it was very likely something more would come to light when these investigations were extended further, as they probably would be. At present antiquarians were not agreed as to what the date should exactly be. Some of the antiquarians took it as far back as Mr. Gowland was inclined to put it, and others to a later date. But they were working from two different points of research—the evidence of tools and astronomical data, and if they took the two they got what appeared to be an average mean. Those excavations had raised another point. People had put forward theories about Stonehenge being the work of different times or of one time. Antiquarians argued that the blue stones were in position first, and that the others were added, because the blue stone was of a very sacred character. Others had stated the contrary. Those excavations had decidedly shown the fact that the whole monument was one erection. In every one of those excavations the blue stone chippings and the sarsen chippings had been found mixed up together, and at all depths, and he thought that proved the fact beyond all doubt. The preponderance of blue stone chippings over the sarsen chippings was explained on the ground that as the sarsen stones were much greater in bulk, they must have been partially dressed where they were found before they were brought to the side of the monument. Then some interesting evidence came to light as to the way in which Stonehenge was built. It was argued that the great stones were got into position by sinking a hole, into which the stone was finally to go, and then cutting away one side to form an inclined plane, so that the stone would slip into the hole, and would be partially brought up to a sloping position, and then be levered up, and by degrees got into a vertical position. That was easy if they were given unlimited labour. But there came the question as to how the lintels were put up. In conversation with Mr. Gowland he suggested a way which was ingenious, and one could see how possibly it had been done. Mr. Gowland argued that just in the same way that people began to build a house in Japan, by building the roof first and then the house underneath; so they put up these great stones, lifting the great lintel by packing until they got it into its right position. There was one point he would like to ask a question upon. In a paper read very recently before the Royal Society on the question of the orientation of Stonehenge, it was said there could be no doubt whatever that Stonehenge was roofed in, and he would like to know how Stonehenge could have been roofed in. Looking at it from purely a layman's point of view, he could not imagine how this could have been done. There were certainly no marks on any of the existing stones, and there were no signs of a filling in between the uprights with rubble. The only way he could imagine it might have been roofed in was by a roof of skins.

Mr. Penrose said there were two or three questions he would like to ask. He understood that the chippings of blue stone were less than of the sarsen.

Mr. Blow said that was so because the places which were excavated were at the sarsen stones, and they naturally found many more chippings there than of blue stone.

Mr. Penrose said that with regard to the point raised respecting the roofing in, his impression was that the place was covered in with flat logs of wood, which could easily have been placed there so that a dark sanctuary was obtained. With regard to the lifting of the stone, he did not think that there need be much question, as much higher stones than even the great lintel at Stonehenge, or even than the great standard itself, were lifted up in early days.

The Chairman remarked that he was quite sure it was only necessary for him to say how exceedingly interesting that evening had been. He thought Mr. Blow was to be congratulated on the work he had done at Stonehenge, and he was sure the country was to be congratulated on having somebody to superintend that work, who had taken the religious care he had in doing it. The scrupulous care with which he had taken up the ground, and taken care of every piece and implement found, showed that the monument could not be in better hands. The astronomical details given by Sir Norman Lockyer were very interesting, but he was afraid they were rather too abstruse for some of them to follow. He was sure that Sir Norman, if he had been asked, would have had great pleasure in proposing a vote of thanks to Mr. Blow that evening, but as he had not done so he (the Chairman) would move such a vote.

The resolution was carried with acclamation.

Mr. Blow, in reply, said that with regard to the preponderance of any one kind of chippings, they found evidence from the excavations made that the whole place must have been a mason's yard, but what they had come upon was not sufficient to go on as to what would be the case over the whole site. With regard to the orientation of the place he would like to hear more about that as time went on. There had really been no good reason put forth for the curious way in which chancels of churches did lean to the south very often, and it might be investigated further. With regard to the lintels, that had been answered by Mr. Penrose, but it had struck him that there were plenty of ways of doing that. As the trilithons were greater at the west than the east it suggested the flow of water from the west to the east.

The Chairman announced that Mr. Emerson, the President, found it impossible to get back to the next meeting on February 3, when the presentation of prizes to the students would take place.

THE ARCHITECTURAL ASSOCIATION:

THE usual fortnightly meeting of the Architectural Association was held on Friday evening last week in the Meeting-room of the Royal Institute of British Architects, No. 9, Conduit-street, Mr. W. H. Seth-Smith, President, in the chair.

The minutes having been read and confirmed, the following gentlemen were elected members of the Association, *i.e.*, Messrs. E. J. Harbottle, R. Hebert, J. R. Hobson, L. de B. Kilsey, E. P. Lee, A. G. MacNaughton, H. A. Porter, and W. S. Read.

New Premises Fund.

The Chairman announced the following additions to the fund for the provision of new premises, viz.:—Messrs. R. L. Curtis, 105*l.*; John Leaning, 10*l.* 10s.; H. J. Leaning, 5*l.* 5s.; H. Passmore, 5*l.* 5s.; E. Boehmer, 2*l.* 2s.; M. F. W. Bunney, 2*l.* 2s.; Guy M. Nicholson, 2*l.* 2s.; C. E. Simmons, 2*l.* 2s.; D. Stewart, 1*l.* 1s.; G. H. Smith, 1*l.* 1s.; P. Rider Smith, 1*l.* 1s.; F. J. Potter 1*l.* 1s.; W. B. Dukes, 1*l.* 1s.. The present total amounts to 3,568*l.* 13s.

The Chairman said he was glad to notice that there were more guinea donations to announce that evening.

The Chairman announced that a meeting of the Discussion Section would be held on the 24th inst., when Mr. F. G. W. Buss would read a paper on "The Clerk of Works: his Duties and Responsibilities."

Mr. H. P. G. Maule, Hon. Secretary, announced that the first spring visit would be made, on the first prox., to Christ Church, Brixton-road, by permission of the architect, Professor Beresford Pite.

Mr. T. C. Cunnington then read the following paper on

Architectural and Constructional Engineering.

Mr. President and Gentlemen,—When promising to read a paper upon "Architectural and Constructional Engineering," the paramount idea was to endeavour to interest the members in the subject, whatever may be the diversity of opinion in regard to what I may have to say relative thereto. Nevertheless it is a subject I would suggest it is desirable and advisable that every architect or member of the Association, particularly the younger ones, should seriously consider, having regard to its increasing importance. To lay the subject before you in as concise a form as possible, I will describe a series of steel-framed structures that have been erected recently. In the first place, I propose to deal with American tall structures, and then give some examples of roofs executed to fulfil specific requirements.

In designing tall business buildings on the American principle, the initial inception and purport of their being are business propositions, erected for the advancement of business interests and enlargement of the income of the owner of the site. In buildings so designed many of the engineering problems are shorn of difficulties, and their solution becomes simply the working out of the inevitable and logical trend of the underlying idea of the general plan.

The disposition and subdivision of an enclosed space is the foremost problem, and the first element in its solution is the use and occupation proposed for the building by its owners. This may require few rooms or many, large rooms or small, or a combination of both. Under all conditions which may govern the subdivision of space it is possible, no matter how small or how irregular the necessary dimensions of the proposed rooms may have to be, to so adjust and group their spacings that there will be a regularity and symmetry which permits the introduction of a unit of subdivision. In determining this unit of subdivision the directing factors will be: (*a*) the necessary dimensions of the rooms resulting from the proposed occupation; (*b*) the requirements of the framing of the skeleton of the building; and (*c*) the exigencies of the artistic expression of the proposed external presentation. The unit of subdivision will also be the unit of construction and the unit of design. If the individual rooms are quite small it may be well to combine two or even more into one unit. Within certain limits the economy of metal in the construction of the skeleton leads to the adoption of a large unit. The greater relative strength of the deeper beams, the smaller number of connexions, the smaller number of pieces to be handled, all favour the large unit; and the reduction in number of pillars, affording greater freedom in subdivision and utilisation of space, will enhance the commercial availability and value of the building.

Again, the greater depth of beams and increased dimensions of pillars enlarge contact areas and riveting surfaces at junction points, and thus give better opportunity for attaining a rigidity of connexions, which is, in itself, a long step toward efficient wind-bracing. On the other hand, greater beam depths increase the height of each story, which, where there are legal limitations of height of buildings, may cause the loss of a story, and, therefore, of its possible rental. Increased span and consequent greater height of beams may involve additional cost of floor arches, perhaps counterbalancing, or even exceeding, the saving in cost of beams and pillars.

Whether the unit of subdivision be larger or smaller is undoubtedly an important factor in the artistic success of the external treatment of the building, but the personal equation of the designer and so many other varying conditions influence and affect artistic results that each case must be decided on its own merits. However, the gain in wall surface incident to the use of larger, and therefore deeper, beams is unquestionably also an aid to the artistic development of the design.

Thus far, what has been stated relates to the adaptation of the building to existing conditions and wants. So much capital is invested in a modern high building that its design should embody certain general preparations for possible future changes of use and occupation, so far as these can be made without impairing present usefulness; and, above all

things, its design should embody all that is necessary for ensuring permanence and comparative indestructibility of structure. This at once draws the attention of the engineer to the character of the foundations, unless these should fortunately happen to rest upon a uniformly and permanently incompressible soil.

With all the ingenuity and the economy of time and money incident to its application, it must be admitted that the so-called Chicago raft foundation cannot be recommended for use upon compressible soil, by reason of its liability to serious disturbance by future underground works in adjacent or neighbouring streets; but that the footings should be carried through the compressible strata to the underlying rock, and for this purpose timber piling cannot be trusted as affording a guarantee of safety for many years, unless there is absolute certainty of maintenance of water-level in the underlying soil. This will, in many cases, make concrete piles, or caissons containing masonry or concrete piers, the only scheme of foundation construction which warrants the permanence of the supports of the structure.

The first building I propose to describe will be—

The Park-row Building, New York, Mr. R. H. Robertson being the architect, and whose name is known in connexion with the American Trust Society's Building, the Corn Exchange Bank, &c., and Mr. Nathaniel Roberts, the engineer, the latter being responsible for the whole of the structural steelwork, and it is this portion of the building that I wish more particularly to describe as typical of American high-building construction. The building belongs to the Park-row Construction Co., and occupies the site of the old International Hotel, opposite the Post Office. It is twenty-six stories high in the middle part, while the two towers are each four stories higher, making in all thirty stories. The total height of the building from the level of the kerb in Park-row to the top of the cupolas is 386 ft. The building frontage is 103 ft. 11 in. in Park-row, 20 ft. in Ann-street, and 47 ft. 10 in. in Theatre-alley, while the depth from Park-row to the Alley is 153 ft. 7 in., and the area covered is 15,000 square feet. The structure is carried entirely on piles driven into a sand foundation to a depth of about 20 ft. There are about 3,500 piles used in the construction. They are of round American spruce, free from knots, with the bark left on. They are from 10 in. to 14 in. in diameter at the head, and the load on each does not exceed 16 tons. They are driven at from 16 in. to 18 in. apart, centre to centre, commencing at the centre of each group and working outwards, while the rows are about 24 in. apart, centre to centre. The heads are cut off below the level of ground water, or at 34 ft. 4 in. below the level of the kerb in Park-row. From 12 in. to 16 in. is excavated out around the head of each pile, which space is filled in with concrete composed of 1 part Portland cement, 2 parts sand, and 5 parts broken stone not more than $2\frac{1}{2}$ in. cube. The concrete is levelled up flush with the heads of the piles. Upon the top of the concrete are laid granite blocks to receive the brick piers which carry the grillage beams to be described later.

The column loads carried by the foundations of this building are very high, some of them exceptionally so. It was therefore necessary to distribute the pressure on the grillage beams as evenly as possible. The need for great care in this matter will be evident when we say that the weight of the steelwork alone is 9,000 tons, while Mr. Roberts estimates that the weight of the building is 56,200 tons, or a total of 65,200 tons. Most of the columns rest on distributing girders, each girder carrying, as a rule, two columns, though in one case there are as many as four columns on one girder. The interior columns have no distributing girders, but rest directly on the grillage beams, and have each an independent foundation. Each foundation was separately designed for the load it had to carry, and the size of the girders and the grillage beams vary accordingly.

A typical distributing girder is shown in detail together with the grillage beams and granite coping blocks underneath them. This girder supports two columns, each carrying about 1,100 tons, so that the girder itself sustains a load of about 2,200 tons. It is 26 ft. long and 8 ft. deep, and has four web plates, each $\frac{7}{8}$ in. thick. There are four angles, 6 in. by 6 in. by $\frac{7}{8}$ in., in each flange, together with three plates, each 2 ft. 8 in. wide by $\frac{3}{4}$ in. thick. The girder is carried on thirty-five joist beams 12 in. deep and 5 ft. long, which are separated by distance pieces. In the foundation in question there are four of these distance pieces between every two beams, but in some of the foundations, where the length of the beam is 6 ft., there are six distance pieces between every two beams. The distance pieces are box-shaped, and have milled surfaces which bear evenly on the top and bottom flange of the beams. The grillage beams rest on the top of the granite caps, and are bedded on cement. In the manufacture of all the distributing girders it was particularly specified that the vertical angle iron stiffeners should have a good bearing against the top and bottom flanges.

This girder for Theatre-alley front is carried on sixty-one joist beams 12 in. deep and 4 ft. long, these being placed on the top of the granite caps, as described. All the columns which do not rest on distributing girders are carried on short independent girders which rest on joist beams supported by the grillage beams, so as to distribute the weight evenly over the granite caps of the piers.

The floor beams are generally composed of the joist beams bolted together with $\frac{3}{4}$-in. bolts, and have cast-iron distance pieces between them. There are three or four distance pieces to each span, and they are so made that the flanges of the joist beams will not be less than $1\frac{1}{2}$ in. apart. The beams which carry the fireproof flooring are all tied together with $\frac{3}{4}$ in. bolts to take the thrust of the flat arches. The full diagonal line on this plan represents the horizontal wind bracing which is inserted at each floor level. The floor beams are framed so that the bottom presents two different levels, one 5 in. above the other. In the area, where 15-in. beams are used, the beams and girders are framed flush, the 10-in. and 12-in. beams being framed flush at the bottom, which is 5 in. above the bottom of the 15-in. beams. Box and lattice girders are used for connecting the columns at the walls, and they are attached to the columns in such a way as to make the connexions as stiff as possible, in order that it may do service as vertical wind bracing. Great lateral stiffness is given to the building in this way.

The lattice girders all have the flange angles kept apart, to allow an easy means of attaching the cast-iron lintels and sills. These girders are connected at the top and bottom flanges to angle pieces on the columns, which also give great lateral stiffness to the building.

As stated, some of the main columns each carry about 1,100 tons on the lower length, which rests on the distributing girder, and though this load is not quite the heaviest carried by any individual column, it is not far short of the maximum, and as these columns are in the Park-row front and are typical of most of the others in the building, I have taken them as an example. All the columns are of single-box construction except one, which is double. They are all built up of plates and angles, and are strengthened according to the load they have to carry by the addition of plates. This forms a simple and efficient means of varying the sectional area of the column without materially altering its radius of gyration, and enables a great number of plates of one standard size to be used in different columns, thus reducing very materially the cost of manufacture.

The bottom length of the column, where it rests on the distributing girder, has a flange plate at right angles to its axis, which plate is securely riveted to the body of the column with angles by means of a double line of rivets, while at its upper end, where the next column length rests, it has angles forming a flange, but no plate. The ends of the two lengths of columns are faced so as to bear very truly one on the other, and are riveted together through each angle. In addition to this there are two splice plates, one on each side of the column, as shown. These plates are firmly riveted to the lower length in the shops, but the part projecting above the top is riveted to the next length of column above when they are erected on the site of the building. These rivets pass through the splice plates and the sides of the column. This forms a very strong joint, and is preferable to the method of fixing by means of angles alone, as it makes the whole column much stiffer and better able to resist the side stresses due to wind. This way of jointing the different lengths of the column is adopted from the bottom to the top, so that the combined lengths are formed into one united whole, which extends from the cellar to the roof.

For carrying and fixing the box and lattice girders which carry the walls, and also the floor girders, angle brackets are riveted to the body of the column in order to support the ends of the girder where they abut against the plates. These brackets are stiffened by vertical angles which bear up against their underside, and thus form a very strong support. There is also an angle bracket riveted to the side of the column some distance above the lower one, and in an inverted position in regard to the latter. The distance between these angles is equal to the depth of the girder which abuts against the column at this point, and when the girder is in place its upper flange is riveted to the upper angle in such a way as to add lateral stiffness to the building, for it has been found absolutely necessary in these high buildings, which are subject to great wind pressure, and where it is often very difficult, and sometimes impossible, to put in diagonal wind bracing, that either the method adopted in the present case or the use of knee-brace or portal bracing becomes necessary in order that the building may have the lateral stiffness which is required for its safety.

This method of stiffening by rigidly fixing the girders to the columns is employed in this, the Park-row building, in conjunction with diagonal bracing. In some of the other lengths of columns, the brackets which carry the girders are formed of plates as well as angles, but in almost every case the girders are riveted through the upper flange to angle brackets on the columns.

All the columns in the walls are carried up 3 ft. above the roof beam, and are there connected with a line of 8-in. channel under the coping.

The Montgomery Ward & Co.'s building at Madison-street and Michigan-avenue, in the heart of the Chicago business district, is a twelve-story commercial and office building with 86 ft. frontage, 159 ft. high on Michigan-avenue. For business reasons it was specially designed to be conspicuous, and on this account a tower 390 ft. high and 40 ft. square at the base was made the central feature of the Michigan-avenue front, and which contains thirteen additional stories above the main roof. The lower three stories of the main building are treated as a base, $45\frac{1}{2}$ ft. high, and are faced with rusticated courses. The twelfth story is treated as an entablature, and has a deep roof cornice. The main entrance is through a two-story pedimented portico, embellished with marble sculpture, the tower forming a central feature, rising from the entrance with unbroken shaft lines continuous through the interrupted roof cornice to the top of the eighteenth story, where there is a cornice course, and above it the nineteenth story balcony, with arched windows surmounted by a deep moulding which forms a capital at the twentieth story. Above this the sides of the tower are narrowed to about 30 ft., and at the twenty-second floor begin to converge for the pyramidal roof.

The concrete foundation piers are set on steel grillages on about 1,200 15-in. piles. These are 52 ft. long, driven to 68 ft. below grade, and are calculated for maximum loads of 25 tons each. The steel columns are of closed rectangular cross-section, made up of pairs of channels and flange cover plates, the largest having an area of about 180 square inches of steel. The tower is calculated for a wind pressure of 30 lbs. per square foot on its vertical projections above the main roof, and the remainder of the building is calculated for the same wind pressure on all exposed vertical surfaces of the two end bays of each elevation. The wind stresses parallel to Madison-street are assumed to be resisted by the rigidity of the walls, floors, and partitions, and by the strength of the beam and column connexions. In the direction parallel to Michigan-avenue there is special wind-bracing, consisting of solid plate stiffened knee-braces at the top and bottom of each end of the wall girders, and of horizontal plate girders, 30 in. deep, with 6 in. by 4 in. flange angles, at every story between the corner column and the one adjacent to it. A similar construction on all sides of the tower is carried up to the twentieth story, where the knee-brace brackets are replaced by longer and heavier knee-brace struts connecting the tops of the corner columns to the system of plate girders which forms a rigid horizontal frame-

work supporting the overhanging twentieth floor.

There are twelve outside columns and no interior ones in the tower. Up to the eighteenth story its floor framing consists of two 24-in. transverse joint-beams supported on the two pairs of intermediate columns, and of seven longitudinal lines of 8-in. joist-beams which are supported by these girders and by the pairs of 15-in. wall-girder channels which connect the columns, and in four places by direct connexion to the intermediate columns. A 9 ft. by 10 ft. panel in the middle of the floor has additional framing for the circular elevator shaft. At the eighteenth story light channels, beams, and angles are bracketed out a short distance from the columns just above the floor line to carry a projecting terra-cotta belt course.

The Electric Tower of the Pan-American Exposition was a temporary structure, its framework being of steel members with riveted connexions, and is covered with wooden lath and studs to support the surface of the walls. All the floors are of steel beams and girders filled in solid with concrete slabs. The column foundations are at an elevation of 23 ft., and the floor D 234 ft. above foundations ; the tower is made in vertical panels of from 15 ft. to 24 ft. high. In this part there are twelve outside and four inside columns arranged in four rows of four each. Besides the horizontal and diagonal braces in the side elevations of the tower, there are corresponding systems in the other elevations and sections of all the rows of columns.

The total dead load is assumed at 1,649 tons, and the total live load at 600 tons. The maximum unit strain from live and dead loads is 16,000 lbs. per square inch, and the columns are proportioned accordingly. Where wind strains are added the unit strains are increased 25 per cent.

The piers for the corner columns are made with 9 ft. by 12 ft. concrete footings 2 ft. thick with two 8 ft. square crossed layers of 12 in. by 12 in. timbers, and another layer 5 ft. square on top, to which the pedestals are secured by bolts. The pedestals have gusset plates, stiffened by vertical and inclined angles, riveted to both flanges of the column, and to double 30 in. by 48 in. base plates $1\frac{3}{4}$ in. thick. At the third floor level there are four plate girders, each 5 ft. deep and 34 ft. long, which form a square connecting the tops of the lower sections of the four inside columns. Opposite these girders in the middle panels of the outer faces of the tower are four similar plate girders, each of which is connected with the inside girder by two plate girders 3 ft. deep, which carry one column each of the upper framework of the tower. The other columns of the upper section which start at this level are carried directly by the columns or by the main girders of this tier. All beams and girders are web-connected ; all diagonals are riveted at intersections, and their end connexions are riveted to pairs of gusset-plates which are attached to bent plates on the horizontal members, or are riveted to the column flanges. The columns are spliced with web and flange plates, as before described.

Wind-bracing.—In arranging a building for wind-brace sections, sometimes the floor plans will permit a symmetrical arrangement of the cross-section in which the wind-bracing is to be put. Frequently, however, no such desirable arrangement is possible, and only certain sections can be utilised. This complicates matters somewhat, but careful study will usually permit a satisfactory solution of the problem.

Wind-bracing in a high building performs, during and after erection, the very practical office of facilitating erection by enabling the columns to be maintained in their correct vertical position ; for which the best shop work, the play of the temporary bolts in the holes, is sufficient to allow a serious deviation from the vertical to occur, and with the temporary bracing of wood struts this can rarely be prevented. Departure from the vertical of 2 in. in a height of 100 ft. can readily occur, and is not noticeable except when compared with a plumb-line. Wind-bracing can be made of certain lengths to fit between the columns, and requires that each column shall be in its proper place before the bracing will fit, so that no great error can accumulate.

A careful comparison of the treatment of wind forces as applied to tall buildings of to-day leads one to the conclusion that the designers differ very materially in regard to the forces to be resisted, the strength of material employed, and the most efficient details of construction. A building constructed with a well-proportioned iron frame should be safe if provided with brick partitions, or if the base is a large proportion of or equal to the height, or if the exterior of the iron framework is covered with well-built masonry walls of sufficient thickness, for the rigidity of the solid walls would exceed that of a solid frame to such an extent that, were the building to sway sufficiently to bring the bracing into play, the walls would be damaged before the rods could be brought into action. Hence the stability must depend entirely either upon the masonry or on the iron framing, and in veneer buildings, which are being particularly considered, the latter system of bracing the metal work must be used, with the walls as light as possible, simply enclosing the building against climatic and injurious forces. Each building offers its own peculiar conditions to the carrying out of efficient wind-bracing, and many factors must be considered for a judicious solution.

The height, width, shape, and exposure of the structure, as well as the character of the enclosing walls, will determine the amount of wind pressure to be provided for, while the details of construction, the internal appearance, and the planning of the various floors will largely influence the manner in which the bracing is to be treated.

The shears are undoubtedly reduced to some considerable extent through many practical considerations, having regard to the dead weight of the structure itself, the resistance to lateral strains offered in the stiff lateral riveted connexions between the floor system and the columns, the stiffening effects of partitions (if continuously and strongly built) and linings, coverings, &c., all tend to decrease the distorting effects of the wind pressure.

Exterior Walls—Piers.

Exterior piers which carry their tributory floor and roof loads ; besides, the weight of walls themselves is capable of at least three separate treatments, each suited to its own peculiar circumstances.

1. Where the outside piers are constructed entirely of masonry carrying all of the wall, floor, and roof loads, which come upon them by means of masonry alone, such construction is used in buildings of moderate heights, and constitutes the ordinary type of building.

The objections to such piers of solid masonry are threefold, where structures are higher than (say) sixteen stories, viz. :—

(*a*) The modern requirements of plenty of light and air in all offices demand that the windows be broad and numerous and the piers narrow. In the highest buildings of the present day hardly any masonry construction is strong enough to carry the necessary roof and floor loads besides its own weight for so great a height and with so small a cross section as is desired.

(*b*) The second objection to such large masonry piers is that they take up too much valuable renting space, and where the rent of offices is proportioned at per square foot this becomes a matter of no inconsiderable importance to the owner. Also, the weight of these solid masonry piers would so add to the load per square foot that many of the most remarkable examples of architectural engineering would be well-nigh impossible.

2. The second treatment of which the exterior piers are capable is that in which metal columns carrying the tributory floor and roof loads are placed inside the masonry piers, while the latter support themselves and the "spandrels" only. The spandrels constitute those portions of the exterior walls lying between the piers and over and under the window spaces.

3. The third method of constructing the exterior piers is the one more approved at the present stage of architectural engineering, the one which has undoubtedly opened up the means for building the highest structures. In this all the weights are thrown on the metal columns, which, in place of solid piers, are surrounded with a protective shell or covering only, made of ornamental terra-cotta or brickwork securely anchored to and supported by the columns at the various floor levels. This construction undoubtedly gives the minimum weight per foot of height and makes possible such small piers as are indispensable for light and desirable offices. The increasing value of ground space, the demands for rapid construction, and the necessity for the lightest possible loads on the subsoil, have all contributed to the success of this type.

The spandrels vary greatly, depending largely upon the architectural effect contemplated by the designer in his arrangement of the material, and consequently general descriptions of spandrels can hardly be given as applicable to general practice. The spandrels are supported by the masonry piers where such wall-bearing piers are used, or in the "veneer construction" by the metal columns in the walls. The face of the spandrels may be "flush" with the piers or "in reveal," that is set back from the face of the piers. In the first case the wall presents a nearly unbroken surface except for the terra-cotta sills and window caps, while the second method accentuates the piers and throws the spandrel walls in reveal. The former case is generally of far simpler construction, and avoids many embarrassments in irregular bracketing from the columns which becomes necessary where the spandrels are recessed.

Whatever be our views with regard to these gigantic structures, whether we look upon them charitably as necessities of the time, or condemn them as hideous and vulgar monstrosities, the fact remains that the number of them increases, and we do not think it possible for any one to help admiring, either from an architectural or an engineering point of view, the skill and ingenuity displayed in their construction and the daring boldness of their conception. They may not be beautiful, but at least we may suppose that they are useful, or hard-headed Americans would not continue to build them. Where every square foot of ground has a very high value, they enable a certain available area to be multiplied 20, 30, or perhaps 40, 50, or even 60 times, thus giving facilities for a like financial increase. If they teach us nothing more, they at least show that the architect and engineer can work together so as to produce results which probably neither of them could achieve alone. This is a lesson which in our country we seem slow to learn, but which, if we could but take to heart and act upon, would probably result in adding beauty and security to our structures, whereas at present some of our engineering works justly merit the architectural "finger of scorn" being turned upon them, while the structural attempts of many architects invite the profane ridicule of engineers. Until this lesson has been learned we cannot achieve that measure of success, either architecturally or from an engineering standpoint, that is possible.

The questions to be decided in these modern structures are so numerous and the difficulties so great, that it has become almost a necessity that the work should be specialised, and so it comes about that an architect is made responsible for the general arrangement of the building and for what we may call the clothing of it, while the steel frame or skeleton is the work of a skilful engineer experienced in such matters. There are few architects capable of undertaking both the architectural and the structural details of these buildings, and in some cases where the experiment has been tried the result has been disastrous, for it is manifestly impossible for one man to be able to properly master both branches of the art sufficiently to enable him to meet and overcome the many difficulties to be faced in a way that is possible when specially trained minds are employed to carry out each section.

The field is surely sufficiently wide to prevent any conflict of interests from being felt, and yet how unwilling is each at times to concede to the other his deserved position ! So long as engineers continue to put up structures hideous to a degree in important positions, the necessity for the help of the architect is manifest.

Design and construction are not synonymous terms, as has been proved over and over again ; and when we consider the vast size of some of the high buildings in the States, the amount of capital they represent, and the number of lives depending on their stability, the Americans show their wisdom by bringing to bear in each department the highest specialist knowledge they can command, for by so doing there is no doubt they attain their desired end more quickly, with greater economy, and with an assured safety that would otherwise be lacking. In the old days the architect was sufficient in himself, but now every year he becomes less able to cope with the structural difficulties that enter into

modern building work. Therefore the sooner it is recognised that he must obtain help from the engineer, and the engineer from him, the better will it be for all concerned.

With all our pride in the achievements of modern architecture and engineering, as exemplified in the construction of the modern high business building, we must not forget that structures equally tall, or even taller, have been reared in former generations, and demonstrate by their continued existence that there were long before our day architects and engineers whose command over the materials and forces which make for stability and permanence of structures was at least equal to our own. Yet these ancient structures are altogether unutilitarian, and could not have been otherwise, by reason of the absence in the day of their erection of means of lifting great loads to great heights in quick time and at small cost.

Roofs.

The Buffalo Savings Bank is located at the corner of Main, Huron, and Genessee streets, in the heart of the Buffalo business district, and occupies a rectangle of about 75 ft. by 69 ft., with a triangular extension 56 ft. long on one side. The building is occupied exclusively by the bank, and consists of a two-story main rectangular part, about 130 ft. high, and a three-story wing, about 50 ft. high, on the triangular extension of the plot. In the main part of the building the banking-room, 65 ft. high, occupies most of the floor space. It has an area 59 ft. square, unobstructed by columns, and surmounted by a domed ceiling supported on an octagonal steel framework; between same and the outer walls are galleries, stairways, and corner rooms. Above the dome there is a steel platform supporting an octagonal office story, 11 ft. high and 70 ft. wide, which is surmounted by a domed roof 53 ft. 6 in. in diameter and 33 ft. high above the horizontal ceiling.

The New York Clearing House on plan is an irregular St. Andrew's cross, inscribed in a trapezoid with sides 80 ft. to 93 ft. long. The floorbeams and girders are supported by the walls and by thirty interior columns, and the lower six tiers are continuous across the whole area of the building. In the centre of the building six columns are arranged on the side of a 30-ft. by 40-ft. rectangle, and extend up only to the fourth floor, or sixth tier, above which there is a clear space under a dome 60 ft. 6 in. in diameter on the outside of the framework.

The Dome has a nearly hemispherical exterior surface, and is supported by an octagonal arrangement of web-connected plate girders. It rests on each of these girders, and intermediately on 20-in. rolled beams across their angles which form with them a sixteen-sided polygon. The girders are supported on the tops of the columns at the angles of the octagon except on one side. Here the 16-ft. side of the octagon is the middle part of a 47-ft. riveted truss, which carries the ends of the adjacent girders, and is supported on special columns. This truss has a double-triangular web system, with all connexions riveted. The tension diagonals are flat plates; the bottom-chord web-plates are 18 in. deep, and the fourth story floorbeams are connected to the webs.

The end vertical members of the truss are practically continuations of the columns that support it (see also details Wolverhampton Public Library). These columns are spliced at every story with four web-plates. The bottom of the lower section has eight vertical connecting angles riveted to the vertical web stiffener plates of the extended base, the base being 5½ ft. square, with eight vertical web stiffener plates and four knee-brace angles on the main diagonals to stiffen the corners. Other columns have bases 3½ ft. square, which are similar to these except that the knee-brace angles are omitted, and some of the lighter columns have 2 by 5½ ft. bases stiffened with a pair of plates, which virtually make them double-web girders.

There are *sixteen radial dome trusses*, seated on top of the polygonal framing of girders and having their top and bottom chords riveted at the centre to a pair of horizontal circular steel plates 6 ft. 4 in. in diameter. Each truss is made in two sections, riveted together through the flanges of web members, which are perpendicular to the dome surface. Trussed purlins 6 ft. deep are connected to the trusses in the planes of these members, and support at their centre points intermediate curved rafters extending to the foot of the dome. The trusses are also connected by horizontal circular T-bars riveted to their top and bottom chords, to support the roof and ceiling respectively. The horizontal reactions at the lower ends of the radial trusses are provided for by a circular vertical steel plate like a hoop around their feet.

Mr. R. W. Gibson was the architect of the building.

The Armoury roof of the Forty-seventh Regiment, Brooklyn, is 300 ft. by 197 ft. on plan, and square hipped about 32 ft. high at the eaves and 90 ft. at the ridge. It has four uniform planes, those of the two sides intersecting in a longitudinal ridge line about 104 ft. long, which terminates at junction of hips. There are four main transverse centre roof trusses of a span of 191 ft. 4 in., centre to centre. From the centres of each of the end ones radiate two hip trusses extending to the corners of the building, and one longitudinal truss to the middle of the end wall. Each hip truss also supports two pairs of short trusses parallel to the main trusses. The main trusses are three-hinged arch ribs of 84 ft. rise, seated on piers extended from the inside faces of the side walls just below the floor level. Their intrados is a continuous curve from the floor line at the skewback to the crown; the extrados is a curve of larger radius than that of the intrados, so as to give the truss a depth of about 15 ft. at the haunches and 5 ft. at the crown. The trusses are built entirely of angles and plates, and have T-shaped top and bottom chords and X-braced web members. The horizontal thrust is taken by a pair of eye bars connecting the skewback pins under the floors. The hip trusses are similar to the semi-trusses of the main spans, and the short corner trusses conform to the general design of the larger ones. The vertical ends of the trusses are connected by horizontal struts at mid-height and by light, deep, inclined lattice girders at the haunches. The top chords of the trusses are connected in each roof surface by six trussed purlins of about 34 ft. span, each panel of which supports six lines of wooden rafters. The roof is also braced by diagonal rods in alternate panels of the main part and in the centre panels of the ends, where most of the rafters are omitted to avoid confusion. The depths and seats of the purlins are so arranged on the curved top chords as to set the rafters in three straight lines, forming successively decreasing angles with the horizontal in the three sections from the eaves up to the ridge. A low clerestory is thus formed at the foot of each rafter, and is glazed with pivoted sashlights, affording light and ventilation. Horizontal latticed girders, with vertical webs, are built into the lower part of the ends of the trusses and support cantilever brackets, carrying the gallery around both sides and one end of the hall. The arch ribs and bottom chord-bars are pin-connected, and the short trusses are connected to the hips by bent plates and angles, as shown in the detail drawing. The trusses are seated on massive cast-iron pedestals, each anchored and built into the masonry which react on bottom-bearing plates.

Colchester Town Hall Roof.—The roof over the Moot Hall, about 100 ft. by 40 ft., is constructed with seven principals, the ends of the roof being hipped. The high pitch and the conditions to be complied with necessitated nominally two different systems of trussing. By reference to plans it will be observed that there are two pairs of principals placed 3 ft. 1½ in. centres. This method was adopted to carry the fire and ventilating flues from the lower stories up to the chimney-stacks that are placed on the front slope and near the ridge line, the flue pipes in same being embedded and surrounded in concrete. Seating angles and connecting plates are riveted on the intrados of the principals to receive the wood purlins or framework for the barrel-vaulted ceiling. The principals are made of double angles 4 in. by 3 in. by ⅜ in., and ⅜ in. web plates in the lower part or legs, well stiffened and riveted together. The hip rafters are also made of plates and double angles, so as to receive the purlins and other framing. These principals bear upon the front wall masonry and in the opposite wall upon specially built steel stanchions to which they are riveted. These stanchions stand upon steel plate girders at Moot Hall floor level, the girders being supported by compound stanchions made up of joist and plates, and extend to below the lower basement floor level. The purlins are 3½ in. by 3½ in. by ⅜ in. angles, and trussed, to which are bolted the wood purlins that receive the roof boarding.

Henley Town Hall Roof.

Henley Town Hall roof is constructed with six steel principals, Mansard-shaped outside or extrados, and semi-circular on intrados. Each principal was made in three sections for convenience of transit (the span being 40 ft.). They are bolted on the radial line at the junction where the sloping roof meets the horizontal. They are made of tees, angles, bars, and plates riveted together. Angle seatings and cleats are provided on the intrados to receive the purlins or the principal of the framing.

"*Electra House, Finsbury Pavement.*"

Reverting to what has been previously said respecting the minimum size of piers and superimposed loads, I may call attention to the conditions that had to be fulfilled in this building. By reference to the details it will be observed that the front walls are carried upon stanchions within the granite piers, they (the granite piers) not being of sufficient sectional area to support the superincumbent load. These stanchions, together with the loads previously mentioned, also support the divisional walls and chimney breasts on plate girders, from first floor level to above roof as shown on detail.

The following series of typical examples were then shown on the screen by the lantern :—

Slide No. *Description.*

1.—The Auditorium Buildings, Chicago. Messrs. Alder & Sullivan, architects.
2.—A glimpse of Broadway, New York city, with the buildings of the American Surety Co. and the Manhattan Life Insurance Co.
3.—The St. Paul Building, New York. Twenty-five stories; total height above pavement, 317 ft. Mr. G. B. Post, architect.
4.—The Hotel Majestic, New York. A typical example of steel-frame construction.
5.—The Queen's Insurance Building. Seventeen stories; 226 ft. high. Messrs. G. E. Harding & Gooch, architects.
6.—Three characteristic New York street corners.
7.—A twelve-story New York warehouse.
8.—The St. Paul Building, New York, during erection. Mr. G B. Post, architect.
9.—The Commercial Cable Buildings, New York. Twenty-two stories; 305 ft. high to top of dome. Messrs. G. E. Harding & Gooch, architects.
10.—The Quaranty Building, New York. Messrs. Alder & Sullivan, architects.
11.—The Bowling Green Building, New York. Sixteen stories; 234 ft. high. Mr. W. G. Audsley, architect.
12.—The Postal Telegraph Building, New York Fourteen stories; 191 ft. high. Messrs. G. E. Harding & Gooch, architects.
13.—The steel framing of the Royal Pavilion, New York. Messrs. Rossiter & Wright, architects.
14.—A construction view of the New York Life Insurance Co.'s Building. Messrs. Jenney & Mundy, architects.
15.—A twelve-story warehouse. Messrs. Cleverdon & Putzel, architects.
16.—The R. G. Dun Building, New York. Messrs. G. E. Harding & Gooch, architects.
17.—The Mechanics' Bank Building, Brooklyn, New York. Mr. G. L. Morse, architect.
18.—A constructional view of a thirty-story office building, Park-row, New York.
19.—Photograph of the Park-row, New York, taken when the steelwork had reached to about the tenth story.
20.—Typical plan of one floor of the same building.
21.—Front elevation and sections of the same building.
22.—Details of a typical stanchion from foundation girders to roof level, which shows the sections of stanchions, bracketings, &c., to receive the girders.
23, 24.—Further details of similar stanchions.
25.—Part of foundation piers for the same, thirty-story office building.
26.—The roof over the Moot Hall, New Town Hall, Colchester.
27.—Another view of same roof taken at a higher level. Mr. John Belcher, architect; Wm. Lindsay & Co., engineers.
28.—View showing the stanchions supporting the roof trusses over the same Moot Hall.
29.—Exterior view of Colchester Town Hall during erection.
30.—Part view of steelwork, first and second floor levels, Messrs. Morgan & Co.'s premises, Long Acre. Mr. E. R. Burch, architect; Wm. Lindsay & Co., engineers.
31.—Ground and first floor level of same building.
32.—Reverse view of same building, showing the amount of loading upon the naked steelwork during erection.

33.—Detail of Henley-on-Thames Town Hall roof.
34.—Interior of same roof before covering fixed. Mr. H. T. Hare, architect; Wm. Lindsay & Co., engineers.
35.—View of Electra House, Finsbury-pavement.
36.—Another view of same building, taken from the new electric station, Finsbury-pavement. Mr. J. Belcher, architect; Wm. Lindsay & Co., engineers.

The Chairman said they must all recognise the great pains Mr. Cunnington had taken in the preparation of his lecture, and they were much indebted to him for it and for the diagrams and lantern views he had shown. They had received one or two communications on the subject, which he would ask Mr. Maule to read.

Mr. A. T. Walmisley, M.Inst.C.E., wrote that he regretted that he would not be in London on the occasion of the reading of Mr. Cunnington's paper. It was a useful subject. He thought there were many structures where an engineer might profitably engage the services of an architect for the artistic portions and general arrangements of interiors as well as elevations, but that the structural parts to be designed by the engineer should in every case claim the precedence and dictate the outline of design. Look at some of our bridges: take the arch of Westminster Bridge. An engineer knew that no diagram of stresses in ironwork gave the curve here adopted for the arch. Look at the iron parapet of the Victoria railway bridge across the Thames at Battersea! An engineer admired it because it was a design that could not be made in masonry.

Mr. W. E. Riley, Superintending Architect of the London County Council, in his communication, said he had been looking recently at some views of Lower New York, and they seemed quite unfamiliar to him although he was there frequently up to thirteen years ago. The erection of numerous high buildings had brought about this great change. The narrow tongue of land between the East and Hudson Rivers, with the Haarlem River on the north, particularly hampered extension laterally, and thus was evolved in the resourceful American mind the expedient of carrying up buildings to great heights. In these buildings the steel columns were the only portions of the structure which were carried to the foundations, and they provided the reactionary forces of the weights of the buildings, each story being carried independently of the one above or below it. The cubical extent of some of the high buildings in New York must necessarily be very considerable, especially in comparison with London buildings, where, as was well known, special permission was necessary to allow buildings of the warehouse class to be of a greater cubical extent than 250,000 cubic ft., in which cases the buildings must not exceed 60 ft. in height, nor be of a maximum capacity of more than 450,000 cubic ft. He recently attended a Congress at the Paris Exhibition, and noted that one of the continental speakers drew some very forcible illustrations as to the height permitted for buildings even in London, but the horror with which he spoke of buildings twenty-two stories in height in New York City was quite indescribable. These were representative European views, because in Europe buildings were not hampered by the geographical conditions which obtain in lower New York City, although this consideration does not apply to other American cities where similar high buildings are erected. But it must be borne in mind that American cities have been laid out on modern lines, with the special advantage of enjoying a maximum of sunshine, whereas in London the limited amount of sunshine must be regarded as a factor in considering the height of buildings in relation to open spaces. The newest building code of New York City, which came into operation in October, 1900, is an interesting document. In its provisions it is noticed that any hotel, lodging house, school, theatre, gaol, police station, hospital, asylum, institution for the care or treatment of persons, which exceeds 35 ft. in height, shall be fireproof, and every other building which exceeds 75 ft. shall be similarly constructed. In a recent book on fireproof construction: "How to Build Fire-proof," by Mr. F. C. Moore, there were recorded some very interesting experiences on the behaviour of high buildings in cases of fire, and illustrations were given of the Home Life Building, which was 192 ft. high, and was intended to be fireproof. A building of five stories adjoining it took fire, and burned out every floor of the Home Life Building above its own height. The disaster appeared to have resulted through a shallow court, 20 ft. wide, used for lighting the higher building, drawing up the flames and communicating them from one window to another in the progress of the fire in the higher building. The court acted like a purposely constructed chimney in its destructive effect, though how a reputed fire-proof building burned so freely and fiercely was not so apparent. The destruction of the Windsor Hotel made a great impression in this country. The hotel was substantially built, and it was stated in some papers to have been fire-resisting, though that statement was inaccurate, as it was elicited that the floors were of open wood joists; some of the partitions were formed with "quarters," and the internal wall finishings were of wood. Such a building would hardly be classed as fire-resisting here; at any rate, it burnt with such furious rapidity that it was practically gutted within an hour and a half. There was no doubt that every such building should be as uninflammable as modern science could make it. The responsibility of dealing with life and property in such a structure was a burden no public official should be called upon to undertake. In spite of the most heroic efforts, and an expert corps of fearless, brave men, many lives were lost and property totally destroyed. In the case of the Home Life Building, the effective water head was, he understood, 108 ft., but that failed to save the building up to that height. The subject of high buildings was one of great interest, and its developments were being carefully watched. Many experts in New York City were bitterly opposed to high buildings, and freely condemned the result of recent years' work as a hideous disfigurement of the city. These views found many supporters here, but perhaps a better acquaintance with the conditions which were responsible for the problem might soften the criticisms. American engineers and architects were hampered by no insurmountable traditions. When a city railway was a necessity it was not put in an "underground" tunnel, as in London, but erected on stilts, and it answered its purpose very well. The systematic method of American thinkers had been to first grasp the difficulties to be overcome, and then attempt to solve the problems in the most practical and commonsense way, unbiassed by prejudice. If the tall building was not all that could be desired, it was another effort to solve a difficulty, and, as experience was gained, it might ultimately lead to some satisfactory result in America, but it did not seem a suitable form of structure for this part of the world.

Mr. Lewis Solomon wrote that he noticed that the author of the paper said that designers differed very materially in regard to the forces to be resisted, the strength of material employed, and the most efficient details of construction. This must be so in designing work of this nature, and it was in the different method of treatment that the clever designer varied from the every-day practitioner. Mr. Cunnington also said that the stability of a building depends entirely upon the masonry or the framing outside pure construction. He (Mr. Solomon) thought that should be emphasised somewhat, as young men were apt to think that the enclosing portion of a building was of such little use. In regard to the different treatment of exterior walls of a building, he thought the second of those described was only a variety of the third, and that only two methods should have been mentioned, viz., one where the masonry carried the superstructure, and the other where the iron carried the masonry, as the masonry in the second scheme was carried by the ironwork in a tall building. He agreed with Mr. Cunnington that few architects were capable of undertaking both the architectural and structural details of a tall iron building, but architects should design the system and leave the details to be filled in by the engineer. With regard to the roof construction, the paper led one to believe that iron domes were almost a new feature, but they were not so, as he remembered over thirty years ago, when he was connected with the design and carrying-out of the Ottoman Bank in Throgmorton-street, that there was an iron dome to the board-room, the ironwork of which, he thought, was designed by Mr. Homan (now of the firm of Messrs. Homan & Rodgers), but the architectural work was not done in any way by the engineer. In the description of Henley Town Hall, it was stated that each principal was made in three sections for convenience of transit. Some explanation of the joining of these sections might be given with advantage. He did not quite understand why reference was made at the end of the paper to the "Electra House," Finsbury-pavement, as there was no special engineering question concerned in a matter where the architect had adopted an ordinary form of construction, viz., bedding stanchions inside masonry. As far as the architecture of this building went, it was only what one might expect from such an accomplished architect as Mr. Belcher.

Mr. Thomas Blashill, in proposing a vote of thanks, said he was glad they had had another opportunity of discussing this method of construction of tall buildings, which was so foreign to our own system. He did not think this American system would be copied in this country, but there was much instruction to be got out of a consideration of the details—the splicing and the junctions, for instance, of the ironwork between the girders and the stanchions. No doubt they had noticed that the whole of the stanchions were put together by putting on covering plates at the joints. That was not done much in this country, but it seemed a good way of putting the stanchions together. He did not know whether we quite realised the size of some of these tall buildings which were to be seen in America. He noticed that the height of one of them was 386 ft.—that was one and a half times the height of the western towers of Westminster Abbey, with 50 ft. to spare, and it was within 18 ft. of the top of the cross of St. Paul's Cathedral. The heights of some of these buildings were enormous. It was to be noticed that the wall of a building in these tall structures was getting to be of less and less consequence, and there was no reference to such walls as were referred to in our Building Act. The walls of each story in these tall buildings were sufficient for each story, and carried nothing but themselves. Another thing he would mention—and he did so with a view rather of suggesting to architectural students that they should study scientific construction a little more—was the separate action of an engineer and an architect, neither of whom had very much sympathy with the work of the other. That did not seem to be exactly what one should desire, or what one would expect to lead to quite the happiest result. As regarded external design, combined with safety of construction, it would pay the young architect, in every sense, to study carefully such drawings as they saw before them that evening. There were now a good many books to be got, and a good many lectures had been given, on various parts of the subject, and it was not now so difficult as it was to study the various parts and details. They should look to the joints more particularly, for there they could learn a great deal. With regard to iron construction generally—architectural construction he referred to chiefly—at the present time the different engineering societies—the Institution of Civil Engineers taking the lead—were at work with the object of standardising the different parts of ironwork, and he might add that he had been appointed to a seat on the committee on the subject. As far as architects were concerned, they were more interested in the standardisation of joists. The idea of the committee was to do away with many degrees which now exist, and to get only joists of the size wanted. At the present time if one wanted a joist of a particular size, it was quite a matter of uncertainty whether it could be got at once, or even if it could be got at all; and the object of the committee was to settle, after a conference with architects and engineers, certain sizes—not too many, but enough—which manufacturers of any consequence would roll and keep in stock.

Mr. Max Clarke, in seconding the vote of thanks, said that Mr. Cunnington had practically told them that they as architects should steer clear of designing these purely engineering structures and leave that for the engineer to do, and he (the speaker) thought they would all agree with that. There was no doubt that if the time should unfortunately arrive when such structures were built in London the architect and engineer would *have* to work together. He was very anxious to know more about the foundations of these tall buildings. The piles in one instance referred to by the lecturer were from 10 in. to 14 in. in diameter at the head, and they were driven in at from 16 in. to 18 in. apart, centre to centre. Later on it was

stated that concrete was put all round, the space being from 12 in. to 16 in. around the head of each pile; but he did not understand how it was done. He would like to know whether the piles were driven in in rows, and, if so, whether the rows were adapted to the large girders which were placed upon the top It would be a great advantage to the younger members to know how the Americans disposed the concrete round the head of the piles. He once had some work of the kind to do and he was put to much trouble in the matter. They were told that piles were undesirable where there was no certainty of the maintenance of the water level in the underlying soil, *i.e.*, unless the water level were not liable to rise and fall; and that, of course, was a fact. He would like to know whether iron piles had ever been used in America for this purpose, and if so, what the effect had been. Could the lecturer give them any information in regard to what was usually called "a clothing for the ironwork"? Were the large girders in these tall buildings protected in any way?—for that was a matter for the serious consideration of constructors when they built a gigantic structure entirely of steel. What was the life of the steel? And what, if any, was the protection given to it? Some of them may have seen a letter in the *Builder* recently from Mr. E. Atkinson, the organiser of the Mutual Fire Insurance Co. of Boston, asking for information of the kind.* He had the pleasure of meeting Mr. Atkinson recently, and he learned that that gentleman wanted to find out from the English people what they thought of putting concrete round the columns. Was it a fact that in "Electra House," on each story of the building the stonework was built independently of the stonework on the other stories? He understood that the steelwork of "Electra House" carried the floors, and that it was surrounded by stonework which supported itself entirely from top to bottom. It was a question whether the Building Act would allow each panel to be kept distinct and the weight carried on the girder.

Mr. R. Moreland, jun., A.M.Inst.C.E., said, in reference to the foundations, as on the top of the piles were granite blocks, suppose one of the piles moved? There would be a local strain on the granite block, and as granite was not a material to resist tension, it would crack. It seemed to him, therefore, that it would have been better to have used steel instead of granite, although, of course, the steel would have been a great expense—a matter, however, of little account in the erection of these tall American buildings. In London, several large buildings had been floated on what would be called bad foundations. At one large building which he had been interested in, *i.e.*, Harmsworth's, on the Embankment, under Mr. H. O. Ellis, architect, the load was calculated, from various tests, at two tons the square foot. The whole site was brought into action for the distribution of load, and long girders were used immersed in a concrete block covering the site, and he was glad to say there had been no settlement; though he agreed that it would have been better to have gone down to a solid foundation, but the expense prohibited that. We did not have the high buildings or the great weights in England that they did in America. In London there were very few buildings of more than seven stories. Queen Anne's Mansions was an exception, and also the Carlton Hotel and Her Majesty's Theatre—a large block of buildings where the system they had been talking about had been adopted. In the majority of the diagrams of stanchions exhibited, there were a large number of plates on the flanges, but not on the web; the webs were stiffened up, but not to the same extent as the flanges, and in one diagram the stanchion was much deeper than it was wide, and it seemed to him that it would have been better the other way. The radius of gyration being unequal, the stanchion he referred to was not economical. It was difficult to make a stanchion economical from bottom to top—somewhere in its length it would have greater strength than was required. In several buildings he had had to do with, where large plate stanchions had been required, they had used solid steel columns—originally at Harmsworth's, where the whole of the basement was required for printing purposes and where a small diameter was required. These steel columns had been used at the Carlton Hotel, and in several places where an architectural effect was required and a small size. The nearest approach to an American building he had seen in London was that of Messrs. Nicholson in St. Paul's Churchyard, the architects of which were Messrs. Gordon & Gunton. The building was somewhat unique in a way, for there was no brickwork up to the second floor level. It was a narrow building, with glass all round, and the superstructure was carried on steel columns, which were kept back so that the goods could be displayed; the wall above was cantilevered over. As to the depth of girders, that was an important matter. Architects were continually wanting shallow girders, and yet they knew as well as any one the trouble there was with them. A twentieth of the span, or a twenty-fourth, was the usual thing, but in practice it seemed impossible to keep to that, and if that limit were exceeded, a lower stress should be allowed for. As to Mr. Blashill's remarks about the difficulty of getting steel delivered, his firm had lately erected a large stockyard and machine shop, driven electrically, on five acres of ground, at Silvertown, the main object being to give quick and certain delivery. His firm realised the importance of time in these large steelwork contracts, and they could give any delivery required. They had just completed work for Harrod's Stores, in which there had been 1,100 tons of steelwork manufactured and erected since August 26 last—600 tons were erected in six weeks.

Mr. H. H. Statham said the whole question of standardising sizes had arisen from the fact that Americans in some important respects had been able to beat English contractors out of the market, and had done it by keeping a supply of standard sizes ready. That was why English engineers had taken up the question, and it seemed to him, now that buildings were wanted in such a great hurry, and people wanted to get a return for their outlay as quickly as possible, the question of standardising sizes had become a very important one. It would enable architects and engineers to supply what might be called a business demand of the day; but one objection to it, even from an engineer's point of view—an objection which a member of the Institution of Civil Engineers mentioned in a recent discussion on the subject—was that it might lead to a kind of stereotyped specification, and would rather check originality in construction. He would like to know what was the meaning of one rather startling statement in the paper. Mr. Cunnington said that where every square foot of ground had a very high value, these high buildings enabled a certain available area to be multiplied "twenty, thirty, or perhaps forty, fifty, or even sixty times." Was it contemplated putting up buildings of sixty stories? For he could not see how the area was to be multiplied sixty times on any other principle, and that seemed to be more alarming than ever. At the end of the paper, in reference to "Electra House," Finsbury-pavement, Mr. Cunnington said:—"It will be observed that the front walls are carried upon stanchions within the granite piers, they (the granite piers) not being of sufficient sectional area to support the superincumbent load." He thought that was a terrible passage to hear read before an architectural society, and in a paper on architectural engineering. If we were going to build in that way, he did not see where the architecture came in at all. Architecture meant, among other things, not only building that was strong, but building that looked what it was. If we were going to erect a building which entirely depended upon steel piers and framing to carry the load, and then enclosed it with a skin which was intended to make the spectator think that the building was built of granite, but was nevertheless obviously insufficient as such, he did not think there could be a greater disaster to architectural design. The whole subject of these American high buildings was a painful one. He recognised the extreme cleverness of it, and also the manner in which such cleverness was made to serve business interests; but the result was commercial architecture, and the buildings were whited sepulchres. They were totally different in reality from what they looked, and he should respect American architects much more if they honestly put up steel structures and omitted the skin of masonry. The skin was an expensive sham, and it was of very little use. No doubt, when one did not know how these buildings were constructed, they looked very effective. He did not inherently object to tall buildings if they could be got without shutting out air and light; there was an element of the picturesque about them sometimes, and even the sublime; but when one knew that all this apparent sublimity and grandeur of effect was nothing but a skin which hid another construction, one lost all respect for it; and we did not know yet the dangers associated with these tall structures built on a steel skeleton. We did not know how long the steel skeleton would last. It would probably require a good deal of looking after, and already there had been evidence that these buildings were not fireproof by any means, nor so safe as they ought to be. In short, they could only be regarded as a very clever and spirited form of architectural development to meet a sudden demand, and he was looking for the time when even the Americans themselves would question whether they had done the best thing in encouraging this form of construction. The paper was instructive in showing how such buildings were erected, but he hoped the form of construction under discussion would not be adopted on this side of the Atlantic.

Mr. Guy Nicholson asked to what height the water companies in America supplied water. In London, in the case of a building 90 ft. high, the water companies said they could not supply higher than 70 ft., and if water was wanted higher it would have to be supplied by the hydraulic power companies. In the case of a tall building it seemed important that there should be a water supply at the top, if only for use in the case of an outbreak of fire. As to tall buildings in London, Queen Anne's Mansions seemed to be an utter failure: it was so high that the courtyard inside, except on the very lightest days, was all dark at the bottom, and the rooms facing on to it were hardly ever properly lighted. As to foundations, he believed up to now the greatest weight which had been put on very good ground had been 3 tons to the square foot. Well, in the case of a column with 1,100 tons on it, that would give about 370 superficial feet of foundations; and if one high building was put up, another might be put up adjoining it, and if this were done to any extent the foundations, it seemed to him, would cover an enormous area. If piles were driven to great depths in all cases, underground railways would not be possible. He would like to know more about the foundations of these buildings, because he supposed permission was not given to extend the foundations indefinitely.

The Chairman said he was a little at variance, perhaps, with some of the other speakers in thinking that the paper was a valuable one to them in view of possible architectural development in London. When one considered the enormous rise in ground values, the large spans to be covered, the precautions against the spread of fire now necessary—particularly in cities like London, where the streets were very narrow and land very precious—and the need of oftentimes carrying—as was done at Colchester Town Hall—the chimneys in solid masonry or brickwork over these spans, all these considerations appeared to suggest the need of some such development as that dealt with by Mr. Cunnington. What that development would be under our conditions it was impossible to say, and no doubt our municipal regulations would have to be very much varied to meet such requirements; but he looked forward to the time when the Americans would have taught us a good deal in these matters, and we should develop on somewhat the same lines. He did not know whether it would lead, as Mr. Statham suggested, to a deterioration in architecture, for he thought it would be possible to adopt a system of construction which would be a compromise between the untruthful kind of construction which Mr. Statham referred to and our present methods. He thought there was sufficient engineering and architectural talent to make it possible to get a satisfactory development in architectural construction adapted to the conditions of to-day. He was not at all hopeless that something of the kind would be done. What would happen in regard to the laws of ancient lights it was impossible to say; one could not conceive that there could exist anything such as ancient lights in America; or were exorbitant sums paid for them? If standard sizes of steel were put on the market, and if that had any tendency to prejudice design, he thought the result would be, in the future as in the past, that the best architecture would not be hurried,

* See our issue for January 4.

but that, for that reason, it would cost more—people who wanted the best work would have to wait and have to pay for it. Last year Mr. A. T. Walmisley read before them an excellent paper on approximately the same subject,* taking the scientific aspect of the matter; the paper they had had from Mr. Cunnington was an eminently practical one. He would like to know whether any settlement had been noticed in regard to the tall American buildings? As to the possibility of having beautiful buildings built on this method, no doubt many of them had seen photographs, if they did not see the actual thing at the Paris Exhibition, of a model of one of these tall buildings. He thought it showed a very fine building, the upper part of which was a beautiful architectural composition, in spite of its height and squareness.

The vote of thanks having been heartily agreed to,

Mr. Cunnington, in reply, said as to the question raised by Mr. Max Clarke in regard to the piles, he had dealt with the matter in the paper, but he would now describe it on the blackboard. The piles were from 10 in. to 14 in. in diameter at the head, and they were driven at from 16 in. to 18 in. apart, centre to centre, commencing at the centre of each group and working outwards, while the rows were about 24 in. apart, centre to centre. The soil was excavated from the top down to 16 in. or 18 in., and concrete put in, and brought level with the top of the piles, and on the top of that were put the granite slabs which received the brick piers or footings, and then another granite slab. [Mr. Max Clarke: Does the girder rest on brickwork?] It rested on granite. As he understood it, there was a lower granite slab, then the brick footings, and then another granite slab. In some of the footings there were what were called the grillage beams on the top of the upper granite block. [Mr. Clarke: Do the grillage beams come in the centre of the brickwork?] They (the grillage beams or joists) were usually placed 12 in. to 16 in. from centre to centre, transverse to the foundation girder. [Mr. Statham: What do the grillage girders rest upon?] On the granite slabs, and grouted in in concrete. The length of the grillage beams was about the length of the top piece of granite. Or the grillage beams could be put on the top of the brickwork. [The Chairman: It acts as a large template?] That was so. As to settlements in these high buildings, there had been settlements in one or two cases, but nothing of a serious character.

The Chairman announced that the next meeting would be held on the 31st inst., when Mr. C. Harrison Townsend will read a paper on "Originality in Architectural Design."

The meeting then terminated.

COMPETITIONS.

HEARTS OF OAK BUILDING SOCIETY NEW OFFICES.—The names of the successful competitors for this work are:—Messrs. Essex, Nicol, & Goodman, Waterloo-street, Birmingham (first premium); Messrs. Meaby & Webbe, Jessel Chambers, Chancery-lane, W.C. (second premium); and Messrs. Lanchester, Stewart, & Richards, Vernon-place, Bloomsbury-square, W.C. (third premium).

NEW CEMETERY BUILDINGS, WITHINGTON, MANCHESTER.—The designs for the new cemetery buildings at Withington sent in by Mr. Ernest Woodhouse, of Mosley-street, Manchester, have been selected in this competition. Mr. Woodhouse submitted two sets of designs, and he was successful in securing the first and second premiums offered by the Council for the best designs. Mr. R. Knill Freeman was the assessor. The third premiated design was that submitted by Messrs. Alfred H. Mills & Roger Oldham, Brazennose-street, Manchester. Mr. Woodhouse has been appointed architect to carry out the work.

A MATHEMATIC REFERENCE LIBRARY FOR THE NORTH.—We have received a copy of the catalogue of the mathematical department of the Central Public Libraries at Newcastle-on-Tyne, which is a remarkable one for a provincial library. The books and tracts included in it are those in which the first object of the writer has been the exposition of pure mathematics. The catalogue includes publications of this class in various languages and of all periods. We notice that there are no less than thirty-eight editions of Euclid or of commentaries on his work. The whole catalogue under authors' names makes forty-two closely printed pages.

* See the *Builder* for December 1, 1900.

Illustrations.

NATIONAL TELEPHONE OFFICES, VICTORIA EMBANKMENT.

WE gave in our issue of May 26, 1900, a general view and plan of this building, with a description.

The illustration here given is from a photograph of the entrance as seen from Temple-avenue. It was the aim of the architect to produce a satisfactory architectural effect with the maximum amount of window space, as the ordinary classic treatment is in his opinion unsuitable for the lighting of offices in this climate.

The building is faced throughout with Portland stone. The figure-subjects represent Electricity, the Telephone, Commerce, &c. Messrs. Foster & Dicksee were the builders, and the architect is Mr. A. N. Bromley, of Nottingham.

CENTRAL BOYS' SCHOOL, OXFORD.

THIS school is situated in Gloucester Green, and as some old cottages of a picturesque nature had to be destroyed in order to make room for the new building, the School Board wished the new school to be kept as far as possible of a picturesque character.

As the Market-place is often very noisy, it was thought desirable not to place any classrooms facing that direction; the cloakrooms and other offices were, therefore, brought to the front, and bay windows introduced in them to obtain the character desired by the Board. This part of the building is of Doulting stone, the rest being of red and grey brick, and the whole being covered with Yorkshire stone slates.

The site being exceedingly irregular, a triangular hall, top-lighted, has been introduced, the classrooms being grouped round it, with a manual classroom approached by a separate staircase in the rear.

Mr. John Wooldridge, of Oxford, was the builder, his contract being about 5,700*l.*, and Mr. Leonard Stokes, of Westminster, the architect. The drawing was exhibited in last year's Royal Academy exhibition.

HOUSE AT LITTLESTONE-ON-SEA, KENT.

THIS house, known as "Sandycroft," has been built overlooking the sea to the east and the well-known Littlestone golf links to the west. Owing to the peculiar nature of the site and the need for outlook on two sides, the kitchen and offices are below the principal rooms.

Internally the house is finished partly with oak or deal painted panelling and partly canvas-covered walls. The ribbed ceilings were specially designed by the architect and run and enriched, *in situ*, by the plasterer. Mr. John Cash is the architect and Mr. G. F. Davis, of Ashford, the contractor for the whole of the work. The illustration is a first sketch which was exhibited at the Royal Academy; but the design has not been materially altered in execution.

HIGHCOMBE EDGE, HINDHEAD.

THE illustration is taken from a drawing of the staircase of a house in Hindhead. The owner, Mr. Rayner Storr, purchased the handrails, dados, balusters, and trusses from an old Georgian house which formerly stood in Old Palace-yard, on the space now cleared east of Westminster Abbey.

The adaptation of this was no easy matter, but the result has been very satisfactory; and the whole, with the new newel posts and other necessary variations, makes an interesting feature in the house. WILLIAM A. PITE.

GRESHAM'S SCHOOL, HOLT, NORFOLK.

THE accompanying reproduction of the architect's drawing shows a view and plans of the buildings, the plans of which have been approved by the Charity Commissioners, and on which work is now proceeding with the idea that the buildings may be ready for the school by the beginning of the Winter Term of next year.

The present school buildings in the Market Place of Holt were rebuilt about forty-five years ago on the site of the former and original buildings of the school, which was founded and endowed by Sir John Gresham in 1555-1556. The school has recently been reconstituted under a scheme of the Charity Commissioners, and entirely new buildings are being erected on a new site.

The site finally chosen for the new buildings lies on the north side of the Cromer-road, and is a little more than half a mile from the town. It possesses all the advantages demanded for a school site, occupying an elevated position facing full to the south, sheltered on the north and east by good belts of trees, and having a gravel and sand subsoil. The portion of the site to be at present occupied contains over twelve acres of land, allowing ample space for the buildings and playing fields. If it should be found desirable at a future time to enlarge the buildings or playing fields, additional land can be used, as the governors of the school are the owners of the surrounding fields.

The buildings, which are set back from the main road, are designed in two separate and detached blocks, the one on the west containing the Master's house and dining hall, boys' studies and dormitories, kitchens and offices, and that on the east containing the school buildings, assembly hall, lavatories and workshops. The buildings can be connected by a cloister later on if required.

In the centre of the Master's house block is placed the boy's dining hall, and on either side are placed the master's private apartments, and the boys studies and dormitories. There are forty separate studies on the ground floor facing south, and on the first floor over these are the dormitories for the same number. These dormitories have been planned on the open cubicle system, with enclosed dressing-space to each, which gives both a desirable amount of privacy as well as a facility in supervision. The breathing space in the dormitories for each boy is 800 cubic feet. Lavatories and bathrooms are placed at the end of each dormitory. The dining hall is seated for eighty boys, not including the raised portion with a high table, and from the hall a covered cloister leads to the lavatories, locker-room, and out to the playing fields. Over the dining hall is an isolated sick-room with separate bathroom and nurse's room adjoining. On the west side of the dining hall, the remainder of the buildings (which are in three stories) comprise the master's house, communicating on the main stair-landing with a corridor leading to the boys' dormitories by a pass door. In the rear of this are the kitchen and offices, with servants' rooms over approached by a separate staircase.

To the east of these buildings, but in the same line of frontage, is the school building in the form of a three-sided quadrangle, the west side containing the school assembly hall, a large apartment 70 ft. by 32 ft., with tracery windows and open timber roof of a late Gothic type. From the hall a wide corridor runs westward, with classrooms and cloakroom on the north side, ending in a return wing containing the laboratories, workshops, and lecture-rooms. The whole of the building is in two stories, excepting the hall, the greater height of which balances the remainder.

All the classrooms, laboratories, lecture-rooms, and workshops are planned and will be fitted up in the best manner to attain the best light and most effective supervision, and the heating and ventilation have been specially studied. Electric light will be used in the whole of the buildings, supplied from an installation specially erected in the school grounds.

The buildings are carried out in the Domestic Renaissance style of building prevalent in the early seventeenth century (except the hall, which has been given a late Gothic character), and are all faced with red local bricks and Ancaster stone, the roofs being covered with Broseley tiles. Special care has been paid to the sanitary arrangements, and the drainage is conveyed by gravitation to the town sewers; no tanks or cesspools are used for soil or waste drains; and the whole of this work is being carried out by Messrs. Matthew Hall & Co., of Wigmore-street.

The general contractor for the works is Mr. George Riches, of Cromer, Mr. W. Crossley acting as clerk of works. The buildings have been designed by, and are being carried out under the personal supervision of, Mr. Howard Chatfeild Clarke, architect, of London.

THE ANALYSIS OF CEMENT AND CEMENT MIXTURES.

THE current issue of the *Journal of the Society of Chemical Industry* contains a Report of a Sub-Committee of the New York Section of the Society on "Uniformity in Analysis of Materials for the Portland Cement Industry."

A sample of raw cement mixture, and another of finished Portland cement, was submitted to a number ot chemists for analysis, due care being taken in the sampling to ensure that the different samples of each material should be identical in composition. Most of the chemists were connected with the Portland cement industry, and each chemist employed such methods of analysis as he deemed most suitable, but sent a description of the methods used to the Sub-Committee together with the results of his analyses.

The following table shows the extreme differences in the results of the analyses of the raw mixture and finished cement respectively returned by seventeen chemists :—

Cement Mixture.

	Silica.	Oxide of Iron and Alumina.	Lime.	Magnesia.
	per cent.	per cent.	per cent.	per cent.
Maximum	15·75	8·50	41·92	2·14
Minimum	12·78	7·08	39·53	1·10
Difference	2·97	1·42	2·39	1·04

Finished Cement.

	Loss on Ignition.	Silica.	Oxide of Iron and Alumina.	Lime.	Magnesia.	Sulphuric Anhydride.
Maximum.....	3·20	21·56	11·36	64·30	3·15	1·71
Minimum	1·04	19·18	9·32	62·01	2·52	1·30
Difference.....	2·16	2·38	2·04	2·29	0·63	0·41

The results of the analyses, together with the descriptions of the methods used, were sent to Dr. Hillebrand, of the United States Geological Survey, who is a recognised authority on the subject, with the request that he would express his views with regard to the principal sources of error in the work of the chemists, and would suggest a scheme of analysis by which more reliable results could be obtained without prolonging the time occupied for the analysis beyond one working day.

After enumerating the sources of error in the various methods of analysis adopted by the different chemists, Dr. Hillebrand delineates a scheme which he regards as sufficiently accurate for all technical purposes, but admits that it involves extra manipulation. He is of opinion that greater uniformity in the results of analyses cannot be attained without this additional manipulation.

The Report concludes with a detailed "method suggested by Clifford Richardson, for the analysis of limestone, raw mixture, and Portland cement, proposed for trial by the Committee and modified in accordance with the suggestions of W. F. Hillebrand."

The Committee recommends that the samples which it distributed for this investigation be again analysed by the proposed method, and that the results, together with criticisms of the method, be returned to the Chairman of the Committee as soon as possible.

The final results of this investigation will be awaited with interest, but we do not think that cement manufacturers would complain very greatly if the differences in the results of commercial analyses by different analysts never exceeded those quoted in the Report. Unfortunately, analyses of an identical sample of material are sometimes returned by different analysts which exhibit much wider differences.

LADY CHAPEL, BARTON, LANCASHIRE.—A new Lady chapel and sacristies, provided at a cost of 1,000*l.*, have been erected in connexion with All Saints', Barton. The new chapel and sacristies have been designed by Messrs. Pugin & Pugin, London, and built by Messrs. R. Neill & Sons, of Manchester, the altar being the work of M. Charles Beyaert, Bruges; and the triptych carved by M. Lelau Declerk, Courtrai, Belgium, to the design of Mr. Sebastian Pugin-Powell.

AMERICAN WORKSHOP METHODS IN STEEL CONSTRUCTION.

THE following is the abstract of a paper on this subject read at the Institution of Civil Engineers on the 14th inst. by Mr. H. B. Molesworth, M.Inst.C.E.:—

The author, in noticing the fact that many recent contracts for steelwork had been secured by American manufacturers in competition with English firms, suggested that a description of American methods would be advantageous. The quality of American first-class work was excellent, in design, material, workmanship, and finish, and was fully equal to English work. The cost of labour, though higher as regarded the amount earned by individual workmen, was lower than in England when the quantity of work turned out was taken into account. English bridge-works were frequently cramped for room, and hampered with old-fashioned and obsolete machinery, while American works were kept up to modern requirements, and obsolete machinery was turned out as soon as it was superseded by anything more efficient. Works in America usually ran night and day, and American workmen took fewer holidays than English workmen.

The author confined his description to the bridge department of the Pencoyd Works of the American Bridge Company, near Philadelphia, and after giving a general description of the works, traced the material from the bridge-shop yard through the various processes into the loading-up yard, whence it was shipped. The bridge-shop was electrically driven, the cranes and larger machines having each its independent motor. The material was moved longitudinally through the shop on trollies and transversely by electric cranes, the shop was roofed in, and the floor was boarded; the material rested almost entirely on skids, and every process moved it farther along the shop till the finished work emerged at the opposite end to that at which the steel entered. The output in gross tons per man, per annum, averaged :—Draftsmen, 771; bridge-shop, 115; forge, 45; eye-bars, 185; templaters, 2,366.

The steel was open-hearth steel, rather softer than was generally used in England, of excellent quality, and giving very uniform tests. The greatest care was taken to deliver all material into the bridge-shop yard perfectly straightened. The drawings were prepared in a very complete manner, and gave much more information than was usually furnished on drawings in England. Great care was taken to minimise smith's work, and to duplicate as many parts as possible. Stops, guides, automatic spacing punches, and multiple punches were largely used. The angle-shear was used much more than in England, and joists of the largest size were sheared at one cut without any distortion; punches and dies were all made on automatic lathes, and were interchangeable. All the larger shearing-machines were mounted on turntables. Plates were handled under punches by roller frames or goose-necks, and moved by a chisel bar working on a fulcrum. Rimering was done by gantry drills, which resembled a Wellington crane with eight radial drills on it. Pneumatic drills and riveters, and chipping machines of the Boyer type were much used, and bad holes, which were very uncommon, were rimered and not drifted. Ends of long pieces were rimered or drilled by compressed-air drills fed up to the work by a compressed-air cylinder behind them. Large plate-girders were riveted by hydraulic gap riveters mounted on a ram to raise or lower them, the work being suspended from an electric Wellington crane traversed by a switch on the riveter-platform. Ends of members were milled by rotary planers which had heads 4 ft. 6 in. to 6 ft. in diameter, with cutters fixed near the periphery. Angle-stiffeners were bevelled in pairs in a milling machine with fast vertical feed, and fitted perfectly. Large joists or channels were handled with clip-hooks furnished with chisel points.

Very little planing was done in the works; "Universal" plates were used, and were rolled by nearly all American plate-mills without extra charge.

The causes of cheap working in America might be summed up as follows :—

1. The workmen, though more highly paid than in England, turned out a much larger quantity of work.

2. The arrangement of the works was more carefully thought out, and labour-saving appliances were more used.

3. There was more method, and probably more scientific knowledge, in the drawing-office.

4. The works were run night and day.

5. The templating was reduced to a minimum by care in the drawing-office and by the use of automatic machinery and stops and guides.

6. Obsolete machinery was turned out of the works as soon as it was superseded by anything better.

7. All tools were kept in a state of perfect efficiency.

8. Railway freights were lower than in England.

The responsibility for the small output per man in England rested only partially with the manufacturer, who was hampered in every effort to introduce improvements by the action of the workmen. The author suggested improvement on the following lines :—

(*a*) A careful arrangement of works to avoid unnecessary handling and give ample facilities for such as was necessary.

(*b*) More complete drawings.

(*c*) The condemnation and removal of obsolete machinery and the proper maintenance of what was in use.

(*d*) Ample motive power.

(*e*) The more extended use of stops, guides, and multiple and spacing punches.

The saving which was possible by systematic methods in the drawing office, and the use of stops and guides and multiple punches, so as to reduce the templating, was very great. Small portions of the work should be made interchangeable and turned out without having to mark each piece. The use of the spacing-punch obviated the necessity for wooden templates, and for marking.

INSTITUTE OF SANITARY ENGINEERS.

ON the 15th inst. Dr. Thresh, the President of the Institute of Sanitary Engineers, read his opening address, in which he made an interesting summary of the habitual state of town dwellings and streets in what may be called the pre-sanitary epoch, and cited historic evidence of the now almost inconceivable state of filth and unwholesomeness in which people were once content to live, or at all events did live, whether contentedly or not. Even as late as 1842 the Report of the Royal Commission on the Sanitary State of the Labouring Population revealed the most shocking state of things. We have not space to reprint this portion of the address, but it is well that the sanitary condition of many of our towns little more than half a century ago should thus be put on record. Following on this historic portion of his address, Dr. Thresh continued :—

"The year 1842 may be said to have seen the close of the pre-sanitary and the dawn of the sanitary era. In 1844 the Health of Towns Commission presented their report, and in 1848, when another invasion of cholera threatened, the first Public Health Act was passed.

The Town Councils of boroughs were constituted Sanitary Authorities, and local Boards of Health were formed. These authorities were given power to borrow money for works of sewerage and water supply, and also the powers necessary for carrying out such works The Act was, as might be expected, very in adequate and defective, but it had a marvellous effect, and continued in force until the great consolidating and more complete Act of 1875 was passed.

There is one effect produced by the 1848 Act, which, however, must be referred to. Sanitary improvements were urgently needed, and Parliament had given all the powers necessary for raising money, &c., to carry out such improvements; but Parliament could not create sanitary engineers. But the sanitary engineer came into existence. Hitherto there had been no demand for men with such qualifications, and there were few who had had any practical experience in designing or carrying out works of a thoroughly sanitary character. No wonder, therefore, that during the process of evolution many mistakes were made, that much of the work then carried out has since been found to be very defective, and that in many instances one source of danger has been removed by means which introduced another. Sewers were badly constructed and ill-ventilated, drains were improperly laid, inefficiently trapped, the plumbing work was

especially bad, and water supplies were not adequately protected.

In 1875, the Public Health Act was passed, and the Local Government Board placed in control of sanitary affairs. Improvements have since been effected in nearly every town. Hundreds of systems of sewerage and works of public water-supply have been carried out. The grossly insanitary conditions which existed in nearly all houses have been generally removed. Medical officers of health and sanitary inspectors were appointed to discover defects and suggest remedies, and there is now no lack of sanitary engineers ready to plan and superintend anything, from the drainage and water-supply of a cottage to the sewerage of the largest city, or to the bringing of water from the mountains of Wales to the City of London.

Let us stay for one minute to estimate the saving of life effected so largely by the works of the sanitary engineer. The data we require can be obtained from the annual returns of the Registrar-General, and are as follows :—Death-rate per 1,000 population 1841-1850, 22·4 ; 1891-1900, 18·2 ; decrease, 4·2. Estimating the present population of England and Wales at 33,000,000, this decrease represents the saving of 138,600 lives annually, effected almost entirely by the works of sanitary improvement carried out by the sanitary engineers of the past and of the present generation.

In face of this enormous saving of life there are still so-called statesmen who deplore the indebtedness of our sanitary authorities, and call the expenditure of money on sanitary improvements 'unremunerative investments.' Why, gentlemen, no investment is so remunerative. Every right thinking person now accepts the dictum of the late Crown Prince of Austria, "that man is the most precious capital of the State and of society in general. Every individual represents a certain value, and to preserve this as intact as possible, and to its utmost limit, is not only a command of humanity, but also the duty of every community in its own interest." This aspect of the subject is one which has a great fascination for me, but time will not permit me to dwell further upon it.

Much has been done to improve the sanitary condition of the country ; but much more remains to be done. There is still ample work for the sanitary engineer. The gross pollution of air, water, and soil, which was so common half a century ago, is now rarely found ; but such pollution is still going on throughout the length and breadth of the land. We no longer find our towns intersected by open sewers, and fouled by countless heaps of reeking filth, but we have defective sewers polluting the soil, defective drains and sanitary fittings permitting of the pollution of the air, defective methods of excrement and refuse disposal. The danger is not less real because it is concealed. The exigencies of our civilisation, and the consequent growth of towns, the connexion of nearly all houses with sewers and water mains, have introduced fresh elements of danger, and additional problems now await solution. These are so numerous and so important that it is generally admitted our sanitary enactments require revision and codification, and that the whole sanitary administration, to be efficient, should be placed under the control of a special Minister of State.

Of these problems I will only refer to one—the housing of the working classes. The aggregation of the labouring classes in towns is depopulating our rural areas and overcrowding our urban districts, both conditions which are to be deplored, and which sooner or later must be combated if we wish to retain our pre-eminence as a nation.

In the endeavour to improve the housing of the rural labourer many Rural Sanitary Authorities have adopted building by-laws which they find themselves powerless to enforce without preventing the erection of cottages altogether, and thus, by driving the labourers to the towns, making matters worse than before. The so-called model by-laws of the Local Government Board are, generally speaking, excellent when applied to towns, but in many respects they are not adapted to meet the requirements of rural districts. In the former, stability and freedom from risk from fire are of much greater importance than in the latter, and this stability, &c., can only be obtained at a cost which almost prohibits cottage-building in the country. Quite recently the Local Government Board have issued a suggested code of building by-laws for rural districts, which are excellent so far as they go, but they do not go nearly far enough, inasmuch as the Authorities adopting them have no control whatever over the nature of the material of which the buildings are to be constructed, their proximity to other buildings, &c. A builder might put up a whole row of wooden or lath-and-plaster cottages, and in such a manner that if one caught fire the whole lot would inevitably be consumed, and of such a flimsy character that all of them in a few years would become unfit for human habitation.

I mention these by-laws because I wish to suggest that this Institute should consider the subject, with the object of improving those devised by the Local Government Board. If a suitable series could be devised they would be largely adopted, and the country generally be benefited thereby. I should also suggest, as many other associations are greatly interested in this matter, that they should, at a later stage, be invited to co-operate with our Institute.

Work of this character would not only benefit the public, but also indirectly the Institute, and there is no dearth of such subjects which you might with advantage consider. If the Institute is to flourish it must make its existence known outside its own circle of members, and endeavour to obtain a reputation for doing good work. Amongst its Fellows there are many who have acquired special knowledge—knowledge not only of value to their fellow-members, but interesting to the community at large. An organisation such as this, especially if working in accord with kindred associations, should exercise a great influence in any future legislation of a sanitary character. I should like to see such influence secured, so that the opinions of the Institute should be desired, and be always treated with respect.

Progress must be our watchword. The sanitary millennium is not yet. From time to time some definite object should be selected for consideration, and the whole interest of the Institute be centred upon it, so that no session shall pass over without some good work being accomplished. Do not be too ambitious, but be ambitious enough. Enthusiasm in the Council and officers will beget enthusiasm in the Fellows and members, and each step forward will render further progress less arduous. Above all things, we must remember that we are not working for ourselves alone. Selfishness never leads to ultimate success. Our success will be proportionate to our forgetfulness of our individual interests and our acknowledgment of the paramount claims of sanitary progress—a progress which benefits the whole human race."

At the close of the address Mr. E. D. Cecil proposed a vote of thanks to the President for his interesting and suggestive *résumé* of the history of sanitary reform. As a footnote to the first part of the address he mentioned that in the conflict between Paganism and Christianity the unfortunate idea had prevailed that, as the Pagan civilisation included scrupulous cleanliness, and as nothing Pagan could be good, therefore somehow dirtiness was Christian. In reference to the interesting series of reports of fifty or sixty years ago, from which Dr. Thresh had given extracts, he remarked that some of the conditions therein revealed came down to a much later date, as was strikingly proved by the state of Marlborough House, which caused the nearly fatal illness of the present Sovereign, for the whole basement was found saturated with sewage, which had been soaking into the soil and never getting away further for many years previously.

Mr. H. M. Dove, in seconding the resolution, trusted that the Institute would take up such questions as building by-laws and the housing problem, and make its influence felt in the public discussions of those important matters, bearing in mind that their aims should not be selfish, but for the benefit of the community at large.

The Chairman referred to several of the towns which had been mentioned by Dr. Thresh, and especially to the continued erection of large numbers of back-to-back houses in Leeds, in spite of their almost universal condemnation as unhealthy and indecent. Mr. Spinks gave startling illustrations of the evils connected with building blocks of eight houses each, with privies common to all, and said he felt surprised that Dr. Thresh should have left Yorkshire while there was still such urgent need of sanitary reform there. He congratulated the Institute on its new President, and the President upon that encouraging meeting.

THE BUILDERS' FOREMEN'S ASSOCIATION.

THE annual dinner of the Builders' Foremen's Association took place on Saturday at the Holborn Restaurant. In the absence of Mr. J. C. Hill, through a family bereavement, the chair was taken by Mr. G. H. Cakebread. The guests numbered 214, among whom were Messrs. H. J. Strong, G. Thomson, B. Carter, W. Salter, A. J. Arnold, E. Arnold, F. W. Stevenson, A. Bailey, Coxon, Spencer Green (President of the Clerk of Works Association), Gathercole, and Soall.

The Chairman, in proposing "The Builders' Foremen's Association," said they all sympathised with Mr. Hill in the loss he had that day sustained by the death of his mother. Mr. Hill regretted very much that he was unable to preside, but he wished to intimate that he intended to become a life member of the Association. Societies, continued Mr. Cakebread, like this Association were bound to elevate and improve the building trade, and deserved great success.

Mr. H. J. Strong (the President), in response, said the object of the Association was to promote the interests of those engaged in the control and supervision of building and kindred works, by providing a central place where meetings and discussions could take place from time to time on matters of interest to the building and allied trades. A benevolent fund was connected with it, for the assistance of those in distress, and 10*l.* was paid on the death of a member. It was now about nine years since the Association was started. It commenced in a very small way, but the membership was now ninety. They had paid 100*l.* in cases of need, and 160*l.* was invested.

Mr. G. Thomson submitted "The Building Trades." He said that in making a retrospect of the past year they could not report great prosperity. From various causes 1901 had proved much worse than some preceding years. It was remarked by some people that there was a slight falling-off in trade after a few years of successive prosperity—that that was the rule—and the building trades had just passed through a lean year. One of the forces to mitigate against good trade was the long duration of the war in South Africa. He looked forward with hope, after this war was ended, to see the trade of the country reviving to a considerable extent. They read in some newspapers that trade was altogether going from this country. He could not go so far as to say that, because the country still retained pre-eminence in many departments of commerce. However, there was great need for their Association and similar societies to watch the movements of their opponents in Europe and America, and to do all they could to further the interests of British trade, and to do all in their power to retain the pre-eminence of British manufacturers.

Mr. Carter, in reply, said he was pleased to see that this Association was prospering. The employers in the building trades took a keen interest in their foremen, and were glad to see that among other things they had started a benevolent fund.

Toasts to the chairman and visitors concluded the proceedings.

ARCHÆOLOGICAL SOCIETIES.

BRITISH ARCHÆOLOGICAL ASSOCIATION.—At the meeting on January 15, Dr. W. de Gray Birch, hon. treasurer, in the chair, Mr. Forster exhibited a massive piece of lead, the filling of an iron cramp recently taken from the masonry of the remains of the old Roman bridge at Corbridge, in perfect condition. The chairman exhibited a cast of the seal of the City of Canterbury, having reference to Thomas à Becket, also casts of two impressions of the Great Seal of Queen Elizabeth for the Kingdom of Ireland, which, he believed, were as yet unknown and had never been figured. One was from a detached impression on a vellum label cut from a document. The other is attached to a document dated February, 1563, the fifth year of the Queen's reign ; they are of dark yellow or uncoloured wax. The Rev. H. J. D. Astley exhibited, on the part of the Rev. Cæsar Caine, a rubbing of a small coffin-shaped stone slab recently discovered in the church of Garrigill bearing a pair of shears in the centre, probably being the memorial of a shearman or woolstapler. The paper of the evening was read by the Rev. C. H. Evelyn-White upon the "Boy Bishop," a subject out of our

scope to report, as it is a part of religious and social history rather than of archæology. In the course of the paper, allusion was made to the money struck for the Boy Bishop (St. Nicholas' pence), of which several English varieties are known, as well as the Continental "Monnaies des Evêques des Innocens."

WILTSHIRE ARCHÆOLOGICAL SOCIETY.—A special general meeting of the members of the Wiltshire Archæological and Natural History Society was held on the 16th inst. at the Society's Museum, at Devizes. The business laid before the meeting by the hon. secretaries, Mr. H. E. Medlicott and the Rev. E. H. Goddard, was:—"To consider, and if approved, to give effect to provisional contracts entered into, and now recommended for adoption by the Committee, involving the purchase of land and buildings adjoining the Museum with a view to the further extension thereof; also the alienation, subject to covenants for the protection of Museum buildings, of a portion of the land so acquired and other adjoining land already vested in the Society's trustees." A long discussion ensued on these proposals, one or two present advocating the removal of the Museum to Salisbury or Swindon, but in the end the resolutions were carried. Steps were taken for making an appeal for such fund as might be required for the purpose of extending the Museum. A resolution was cordially adopted thanking Sir Edmund Antrobus for the careful and able manner in which he had carried out the restoration at Stonehenge by replacing the leaning stone, &c., thus preserving the ancient monument from further decay and demolition.

THE LONDON COUNTY COUNCIL.

THE first meeting of the London County Council after the Christmas recess was held on Tuesday, at the County Hall, Spring-gardens, S.W., Mr. A. M. Torrance, Chairman, presiding.

Loans.—On the recommendation of the Finance Committee, it was agreed to lend Greenwich Borough Council, 3,200*l.* for the purchase of land for a depot; Shoreditch Borough Council, 14,600*l.* for alteration of offices; Woolwich Borough Council, 8,500*l.* for the erection of lodging-houses for the working classes; Islington Borough Council, 1,700*l.*, 4,125*l.*, and 2,595*l.* for electric light installation; Kensington Borough Council, 23,429*l.* for contribution to street improvement; Westminster City Council, 82,930*l.* for paving works; Battersea Borough Council, 7,500*l.* for erection of baths and washhouses; Fulham Borough Council, 15,000*l.* for erection of baths and washhouses; Fulham Guardians, 1,060*l.* for provision of lavatory accommodation at the workhouse; Shoreditch Guardians, 4,930*l.* for various purposes; Wandsworth and Clapham Guardians, 4,150*l.* for erection of cottage homes; School Board for London, 162,931*l.* for schools, &c.; Metropolitan Asylums Board, 223,970*l.* for various purposes; and Greenwich Borough Council, 3,930*l.* for paving works.

Cross River Traffic, Woolwich.—Mr. Squires presented a petition, signed by over 13,000 inhabitants of Woolwich, who asked that means of traffic across the river at that place should be improved at an early date. The petition was referred to the Bridges Committee.

Technical Education.—The same Committee recommended and it was agreed, after discussion:—

"That, considering that the Council has received requests from the managers of various schools and institutions in the administrative county of London to make provision in aid of technical or manual instruction within the county, the sum of 90,000*l.*, being part of the moneys received by the Council under Sub-section 1 (*b*) of Section 1 of the Local Taxation (Customs and Excise) Act, 1890, in respect of the financial year ending March 31, 1902, be, and the same is hereby appropriated for the purposes of technical or manual instruction within the meaning of the Technical Instruction Acts, 1889 and 1891."

Tenders.—The following tenders have been accepted:—

Engineering tools and sundries, Horton Asylum: Messrs. Mosers, Ltd., 140*l.* and 248*l.*

Electric Lighting, Farmfield (Wiring, &c.): The Anti-Vibrator, Ltd., 450*l.*

Fire-station, Homerton.—The Fire Brigade Committee reported that Messrs. Martin, Wells, & Co., the contractors for the erection of the sub-station at Homerton, had asked permission to sub-let the tiling and slating and the hot-water work to firms of whom the architect approves. The Committee were of opinion that the request should be complied with, and they recommended that Messrs. Martin, Wells, & Co. be allowed to sub-let to Messrs. J. William & Co. the tiling and slating, and to Messrs. G. & E. Bradley the hot-water work at the Homerton fire-station; that the Solicitor do prepare the agreement prescribed by the Council's standing orders with regard to sub-letting.

The recommendation was agreed to.

Tramways.—The meeting was made special, and the necessary resolutions were passed for the purchase of the undertaking of the South-Eastern Metropolitan Tramways Company. The cost to the Council will be 51,000*l.*, and, by a small junction line, cars will be able to run to Rushey-green.

Replying to Mr. Bruce, Mr. Benn said notice had been served on the North Metropolitan Tramway Company to electrify their lines, and they were awaiting a reply as to the best means by which this could be done. They would do all they could to induce the North Metropolitan Company to resume the all-night service.

Cottages, Deptford.—The Housing of the Working Classes Committee reported as follows, the recommendation being agreed to:—

"On December 17, 1901, the Council entrusted to the manager of works the work of erecting the lodging-house to be built on the larger portion of the area cleared under the Mill-lane scheme, Deptford. As we intimated in our report on that date, the remainder of the site will be devoted to the erection of twenty-four cottages. Each cottage will be self-contained, and will consist of living room, scullery, water-closet, and two bed-rooms, with a small garden in rear, and accommodation will be provided for 144 persons. In view of the fact that the manager of works was undertaking the building of the lodging-house we referred to him the plans and estimate for the cottages also. He has now reported that he is not prepared to undertake the work of building them at the amount of the architect's estimate. We think, therefore, that tenders should be invited from a selected list of firms. We submit the working drawings, bills of quantities, and specification in respect of the cottages, but do not at the present stage desire that the estimate should be made public. The Council will incur no liability by authorising us to invite tenders as we propose, and the estimate will be put forward after receipt of the tenders and before any liability is incurred. We recommend—That the working drawings, bills of quantities, and specification in respect of twenty-four cottages to be erected on a portion of the area comprised in the Mill-lane scheme, Deptford, be approved, and that the Housing of the Working Classes Committee be authorised to invite tenders for the erection of the cottages from a list of selected firms."

Housing Scheme, Russell-court, Drury-lane.—The same Committee reported as follows:—

"We submit working drawings, bills of quantities, and specification in respect of Siddons and Stirling-buildings, Russell-court, Drury-lane. These buildings are to be erected for the accommodation of persons displaced by the carrying into effect of the Clare Market scheme. They consist of five-story buildings, and will provide accommodation for 390 persons in ten tenements of one room, thirty tenements of two rooms, thirty-five tenements of three rooms, and five tenements of four rooms. We have considered the question whether these buildings should be referred to the manager of works or whether tenders should be invited for them, and we are of opinion that a selected list of contractors should be requested to submit tenders. As in the case of the Mill-lane cottages, we do not desire to disclose the amount of the estimate at the present stage, but no liability will be incurred by the Council in adopting the course we advise, and an estimate is not necessary till after the receipt of the tenders. We recommend—That the working drawings, bills of quantities, and specification in respect of Siddons and Stirling-buildings, Russell-court, Drury-lane, be approved, and that the Housing of the Working Classes Committee be authorised to invite tenders for the erection of the buildings from a list of selected firms."

Improving Piccadilly.—Mr. Emden asked whether the Improvements Committee were considering the question of improving Piccadilly westwards.

Mr. Goodman, in reply, said the matter was on the Agenda, but it depended a great deal on the sympathy which would be shown towards the Committee by the freeholders and leaseholders.

The Opening-up of Roads.—On the motion of Mr. Foster, it was agreed:—"That in consequence of the growing evil, resulting in loss of life and injuries to persons, damage to business, and danger and delay to vehicular traffic caused by the frequent and continuous opening of roads, it be referred to the Highways Committee to consider and report as to the best means for the Council to procure such statutory powers as to secure that all persons or companies having Parliamentary powers to open the roads shall be compelled to give adequate notice to the Council before exercising such powers, and that the Council shall have the power to make such regulations and have such supervision as will ensure such work being done expeditiously, and with full regard to the public safety and business interests."

Relief of Traffic.—On the motion of Captain Swinton, it was agreed:—"That, having regard to the fact that the traffic in main thoroughfares becomes daily more congested, and that such congestion, though assisted by the mixture of slow and fast draught and the narrowness of the streets, is even more certainly caused by cross traffic, it be an instruction to the Improvements Committee to consider the possibilities of some 'over and under' arrangement, by means of bridges or subways, in or about every spot where two large streams of vehicles have now perforce to wait to cross each other."

Inspection of Kitchens.—On the motion of Mr. Foster, it was agreed:—"That considering the thousands of persons in London whose business compels them to have the greater part of their food in public restaurants and eating-houses, and in view of the great importance to the public health that such food should be prepared in wholesome and sanitary surroundings, it be referred to the Public Health Committee to consider and report as to the best means to exercise periodical inspections of the kitchens of restaurants and eating-houses, on similar lines as bakehouses and factories are inspected."

The Council adjourned at seven o'clock.

APPLICATIONS UNDER THE LONDON BUILDING ACT, 1894.

THE London County Council on Tuesday dealt with the following applications under the London Building Act, 1894. Unless otherwise stated, consent was given on conditions. The names of applicants are given between parentheses:—

Lines of Frontage and Projections.

Strand.†—Four two-story oriel windows and three balconies on the eastern front and two balconies on the northern front of a block of buildings to be erected on the site of No. 36, Bury-street, and Nos. 19 and 21, Ryder-street, St. James's (Mr. R. J. Worley for Mr. J. Beale).—Consent.

Hammersmith.—A one-story addition on part of the forecourt of No. 160, Goldhawk-road, Shepherd's Bush (Mr. C. G. Baker for Dr. A. Woodforde).—Consent.

Paddington, North.—Balconies at the first, second and third floor levels in front of a block of residential flats on the south-east side of Elgin-avenue, Paddington, at the corner of Biddulph-road (Messrs. Boehmer & Gibbs for Mr. H. C. C. Shaw).—Consent.

Poplar.—A theatre building on the north side of East India Dock-road, Poplar, abutting upon Stainsby-road and Canton-street (Messrs. Owen & Ward for the Eldorado Theatre, Limited).—Consent.

Clapham.—A turret, to be constructed of wood covered with lead, on the roof of a house on the north side of Battersea-rise, Battersea, at the corner of Limburg-road (Mr. G. E. Nield for Mr. W. J. Vokes).—Consent.

Clapham.—A two-story oriel window at the first and second floor levels in front of a house on the north side of Battersea-rise, westward of Limburg-road (Mr. G. E. Nield for Mr. W. J. Vokes).—Consent.

Hampstead.—Two-story bay-windows to two dwelling houses on the north side of Finchley-road, Hampstead, between Heath-drive and Frognal-lane (Messrs. Davis Brothers).—Consent.

Hampstead.—The retention of a fodder-store and the erection of a tool-shed at Cranbrook stables, Nutley-terrace, Hampstead (Messrs. White & Page for Mr. J. Duveen).—Consent.

Hoxton.—An iron and glass shelter over the entrances to the London Music-hall, High-street, Shoreditch (Mr. F. Matcham for the London Music Hall Company, Limited).—Consent.

Lewisham.—That the application of Mr. J. W. Brooker for an extension of the period within which the erection of six houses on the east side of Brockley Rise, Lewisham, at the corner of Brockley Park, was required to be commenced be granted.—Agreed.

Marylebone, East.—A bay window in front of No. 75, Welbeck-street, St. Marylebone (Mr. F. M.

Elgood for Messrs. Debenham & Freebody).—Consent.

Peckham.—A one-story shop on part of the forecourt of No. 24, Gibbon-road, Nunhead (Mr. J. Sykes).—Consent.

St. George, Hanover-square.—An oriel window at the first, second, third, and fourth-floor levels, with a turret over, in front of Nos. 24 and 25, Princes-street, St. George, Hanover-square (Messrs. W. G. Bartleet & Son for Messrs. H. G. Porter & Co.).—Consent.

St. George, Hanover-square.—That the application of Messrs. C. Mellier & Co. on behalf of Mr. G. D. Faber, M.P., for an extension of the period within which the erection of a stone portico at the entrance to No. 14, Grosvenor-square, St. George, Hanover-square, was required to be commenced, be granted.—Agreed.

Wandsworth.—A house and a stable building on a site on the west side of Marlborough-road, Putney, to abut upon Bramcote-road (Mr. J. C. Radford for Mr. C. Merrett).—Consent.

Wandsworth.—Nineteen houses on the south side of Grove-road, Balham, westward of a house known as Ravenscroft (Mr. P. Dollar for Messrs. Pickford, Limited).—Consent.

Wandsworth.—Buildings, with one-story shops in front, on the site of Russell House, and the rebuilding of Nos. 122 and 132 (even numbers only), Balham-high-road, Balham (Messrs. Bourchier, Burmester, & Galsworthy for Mr. J. W. Holdron).—Consent.

Westminster.—A one-story shop and porch, on part of the forecourt in front of No. 119, Victoria-street, Westminster (Mr. B. Woollard for Mr. J. Browne-Martin)—Consent.

Lewisham.†—Bay windows in front of Nos. 9, 11, 13 and 15, Dowanhill-road, Catford (Mr. G. Tolley for Mr. A. C. Corbett, M.P.).—Refused.

St. Pancras, North.—The retention of balconies on the first, second and third floor levels in front of Nos. 21, 22, 23, and 24, Lissenden-gardens, Highgate (Messrs Boehmer & Gibbs for Mr. A. W. Armstrong).—Refused.

Battersea.—A one-story addition to the National Anti-Vivisection Hospital, Prince of Wales-road, Battersea (Mr. A. Parnacott for the Board of the hospital).—Refused.

Battersea.—The rebuilding of Nos. 117 and 119, Plough-road, Battersea (Mr. W. C. Poole for the Dairy Supply Co., Ltd.).—Refused.

Brixton.†—A three-story addition to the Stockwell Training College on the north-east side of Stockwell-road, Brixton (Mr. J. O. Smith for the British and Foreign School Society).—Refused.

Hammersmith.—Residential flats, with projecting bay-windows, on the south side of Askew-road, Shepherd's Bush, eastward of Ashchurch-road (Messrs. Richardson & White for Mr. J. C. Edwards).—Refused.

Islington, North.—One-story addition on the north side of No. 122, Dartmouth Park-hill, Islington, to abut upon Langdon-road (Mr. R. Midworth for Mr. F. Bryen).—Refused.

Lewisham.†—Iron porches with zinc or tiled roofs at the entrances to proposed houses on the Old House Estate, Sydenham (Messrs. I. Edmondson & Son for Mr. J. Edmondson).—Refused.

Marylebone, West.—Wood and glass enclosures to a stone portico at the entrance to No. 54, Great Cumberland-place, Hyde Park (Mr. M. Macartney for Mr. V. T. T. Francis).—Refused.

Marylebone, West.—A signboard in front of the Oxford Stores public-house, No. 418, Oxford-street, St. Marylebone (Messrs. J. & H. Cocks, Limited, for Messrs. Worthington & Co., Limited).—Refused.

Norwood.—A one-story warehouse on the north side of Park-road, West Norwood (Mr. H. Bignold for Messrs. F. Vincent & Sons).—Refused.

Strand.—Signboard in front of the Windsor public-house, No. 427, Strand (Messrs. J. & H. Cocks, Limited, for Messrs. Worthington & Co., Limited).—Refused.

Strand.—A signboard at the second-floor level in front of No. 18, Cockspur-street, Strand (Messrs. Norman & Stacey, Ltd.).—Refused.

Width of Way.

Norwood.—The retention of a one-story building at the rear of No. 6, Gloucester-street, West Norwood, with the external fence of the space between the external walls of the building and Beadman-street at less than the prescribed distance from the centre of that street (Mr. C. Austin).—Consent.

Westminster.—A new roof to form an additional story to Nos. 32 and 34, Great Peter-street, Westminster, at the corner of St. Ann's-lane (Messrs. Wake & Co. for Messrs. Wilson & Pilcher, Ltd.).—Consent.

St. George-in-the-East.†—Twenty houses in Samuel-street, James-street, Langdale-street, and William-street, St. George-in-the-East, and the widening of those streets (Mr. H. H. Collins for Messrs. N. & R. Davis).—Consent.

Hammersmith.—That the Council do make no order with respect to the application of Mr. E. M. Bowyer on behalf of the Kensington Model Laundry, Ltd., for consent to the erection of an additional story on a stable building at the laundry premises, Railway-approach, Goldhawk-road, Shepherd's Bush.—Agreed.

Rotherhithe.—An addition to an engineer's shop at the Princes Dry Dock, Rotherhithe-street, Rotherhithe (Mr. E. C. Homer for the Princes Dry Dock Co.).—Refused.

Space at Rear.

Fulham.—A modification of the provisions of Section 41 (1) (vi.) of the Act with regard to open spaces about buildings so far as relates to the erection of a two-story building, being No. 1, Queensmill-road, Fulham Palace-road, Fulham, with an irregular open space at the rear (Messrs. Allen & Norris).—Consent.

Whitechapel.—A modification of the provisions of Section 41 (1) (vi.) of the Act with regard to open spaces about buildings, so far as relates to the proposed erection of a dwelling-house on the east side of Tenter-street East, Whitechapel, with an irregular open space at the rear (Messrs. N. and R. Davis).—Consent.

Deviations from Certified Plans.

Finsbury, Central.—Deviations from the plans certified by the District Surveyor, under Section 43 of the Act, so far as relates to the proposed re-erection of the Angel Hotel, on the north side of Pentonville-road, Clerkenwell, at the corner of High-street (Messrs. F. J. Eedle & Meyers for Messrs. Truman, Hanbury, Buxton & Co., Ltd.).—Consent.

Width of Way, Lines of Frontage and Projections.

Marylebone, West.—A one-story stable building and of an addition to a studio at No. 16, Grove-end-road, St. John's Wood, to abut on Elm-tree-road, with the external walls of such stable building and addition at less than the prescribed distance from the centre of Elm-tree-road (Mr. J. W. Simpson for Mr. E. C. Stewart).—Consent.

St. George, Hanover-square.—Three two-story bay windows in front of a proposed extension of the Berkeley Hotel, on the east side of Berkeley-street, Piccadilly (Mr. W. H. Lees for the Berkeley Hotel Co.)—Consent.

Brixton.—Deviation from the plan sanctioned on April 30, 1901, for the erection of a block of residential flats on the site of Nos. 400 and 402, Coldharbour-lane, Brixton, so far as relates to the construction of a mansard roof with two dormer windows at such premises (Mr. F. A. Powell for Mr. A. G. H. Brown).—Consent.

Strand.—The retention of stone balconies on the first and second floor levels in front of an addition to the Hotel Dieudonné, Ryder-street, St. James's (Mr. W. Woodward for Mr. Guffanti).—Consent.

Dulwich.—Three houses, with shops on the ground floor, on the west side of Grove-lane, Camberwell, at the corner of Champion-grove (Mr. J. Heath for Mr. T. Freeman).—Refused.

Lines of Frontage and Space at Rear.

Wandsworth.†—Four houses on the north side of Replingham-road, Southfields, eastward of Wimbledon Park-road, with one-story shops in front and irregular open spaces at the rear (Mr. D. Matthews for Mr. G. A. Gale).—Refused.

Kensington, South.†—Seven one-story shops on the south side of Pembroke-road, Kensington, to an advanced line of frontage, and the erection of residential flats on the west side of Cromwell-crescent, with irregular open spaces at the rear (Mr. P. E. Pilditch for Messrs. J. Barker & Co., Ltd.).—Refused.

Projection and Construction.

Lewisham.†—A wood and glass pent in front of a stable at Woodthorpe, Beckham-lane, Beckenham (Mr. C. Sargent for Mr. F. Simonds).—Refused.

Formation of Streets.

Lewisham.†—That an order be issued to Messrs. Norfolk & Prior, sanctioning the formation or laying out of a new street for carriage traffic out of the east side of Ravensbourne Park, Catford, and in connexion therewith the widening of a portion of Ravensbourne Park (for Mr. J. Barlow).—Consent.

Wandsworth.—That an order be issued to Mr. A. W. Iles, sanctioning the formation or laying out of a new street for carriage traffic to lead from Garratt-lane to Wimbledon-road, Summers-town, Wandsworth, and in connexion therewith the widening of a portion of Garratt-lane. That the name Keble-street be approved for the new street.—Agreed.

Fulham.—That an order be issued to Mr. T. V. Smith and to Messrs. W. & A. Atkinson, sanctioning the formation or laying out of three new streets for carriage traffic out of Fulham Palace-road and Brandenburgh-road, Fulham. That the names Rannoch-street, Lochaline-street, and Parfrey-street be approved for the new streets.—Agreed.

Lewisham.†—That an order be issued to Mr. J. W. Webb, sanctioning the formation or laying out of new streets for carriage traffic on part of the Crofton Park Estate, on the eastern side of Crofton Park-road, Brockley. That the names Stillness-road (in continuation), Bexhill-road, Salehurst-road, Ticehurst-street, and Rolvenden-street, be approved for the new streets.—Agreed.

Islington, North.—That an order issued to Messrs. C. Bell, Withers, & Meredith refusing to sanction the formation or laying out of a new street for carriage traffic to lead out of the south-west side of Highgate-hill, Islington (for M. G. H. Schofield).—Agreed.

Woolwich.—That an order be issued to Mr. J. O. Cook refusing to sanction the formation or laying-out of a new street for carriage traffic to lead from Woolwich-road to Wrekin-road, Plumstead (for Mr. W. G. Dawson and Mr. J. Harper).—Agreed.

Artisans' Dwellings.

Finsbury, East.—That the Council do make an order as follows: Whereas Mr. R. Robertson, on December 20, 1901, under the provisions of Section 42 of the London Building Act, 1894, delivered on behalf of the Housing of the Working Classes Committee of the Council, at the County Hall, plans of two blocks of intended dwelling-houses, to be inhabited by persons of the working class, and proposed to be erected, not abutting upon a street, on a site at the rear of houses in Old-street, George-street, and Mitchell-street, Finsbury. . . . Now the Council does by this order sanction the said plans so far as Section 42 of the said Act is concerned. . . .—Agreed.

Rotherhithe.—That the Council do make an order as follows: Whereas Mr. R. Robertson, on December 21, 1901, under the provisions of Section 42 of the London Building Act, 1894, delivered on behalf of the Housing of the Working Classes Committee of the Council, at the County Hall, plans of a block of intended dwelling-houses (to be known as Sandwich-buildings), to be inhabited by persons of the working class and proposed to be erected, not abutting upon a street, on a site on the western side of Swan-lane, Rotherhithe, at the corner of Kenning-street. . . . Now the Council does by this order sanction the said plans so far as Section 42 of the said Act is concerned. . . .—Agreed.

Means of Escape from Top of High Buildings.

St. George, Hanover-square.—Means of escape in case of fire, proposed to be provided in pursuance of Section 63 of the Act, on the seventh and eighth stories of an addition in Berkeley-street to the Berkeley Hotel, Piccadilly, St. George, Hanover-square (the upper surface of the floors of which stories will be above 60 ft. from the street level) for the persons dwelling or employed therein (Mr. W. H. Lees for the Berkeley Hotel Co.).—Consent.

St. George, Hanover-square.—Means of escape in case of fire, proposed to be provided in pursuance of Section 63 of the Act, on the eighth story of the northern portion of a block of residential flats on the west side of Harewood-place, Oxford-street, St. George, Hanover-square (Mr. P. Hoffmann for Mr. H. Lovatt).—Refused.

Buildings for the Supply of Electricity.

Marylebone, West.—Building for the supply of electricity, proposed to be erected on the site of Nos. 35, 36, and 37, North-street, St. Marylebone (Mr. W. H. White for the Metropolitan Electric Light Supply Co., Ltd.).—Consent.

Cubical Extent.

Fulham.—The erection on the south-eastern side of Townmead-road, Fulham, and abutting upon the river Thames, of a building to exceed in extent 250,000, but not 450,000 cubic feet, and to be used only for the purposes of the manufacture of steam-engines and foundry-work (Messrs. Masson, Scott, & Co, Ltd).—Consent.

Hackney, North.—The erection on a site on the west side of Tyssen-street, Dalston-lane, Hackney, at the corner of Tyssen-passage, of one division (known as Block 2), of a factory building, to exceed in extent 250,000, but not 450,000, cubic feet, and to be used only for the purposes of a cabinet and joinery works (Mr. E. O. Sachs for The Shannon, Limited).—Consent.

Height of Building.

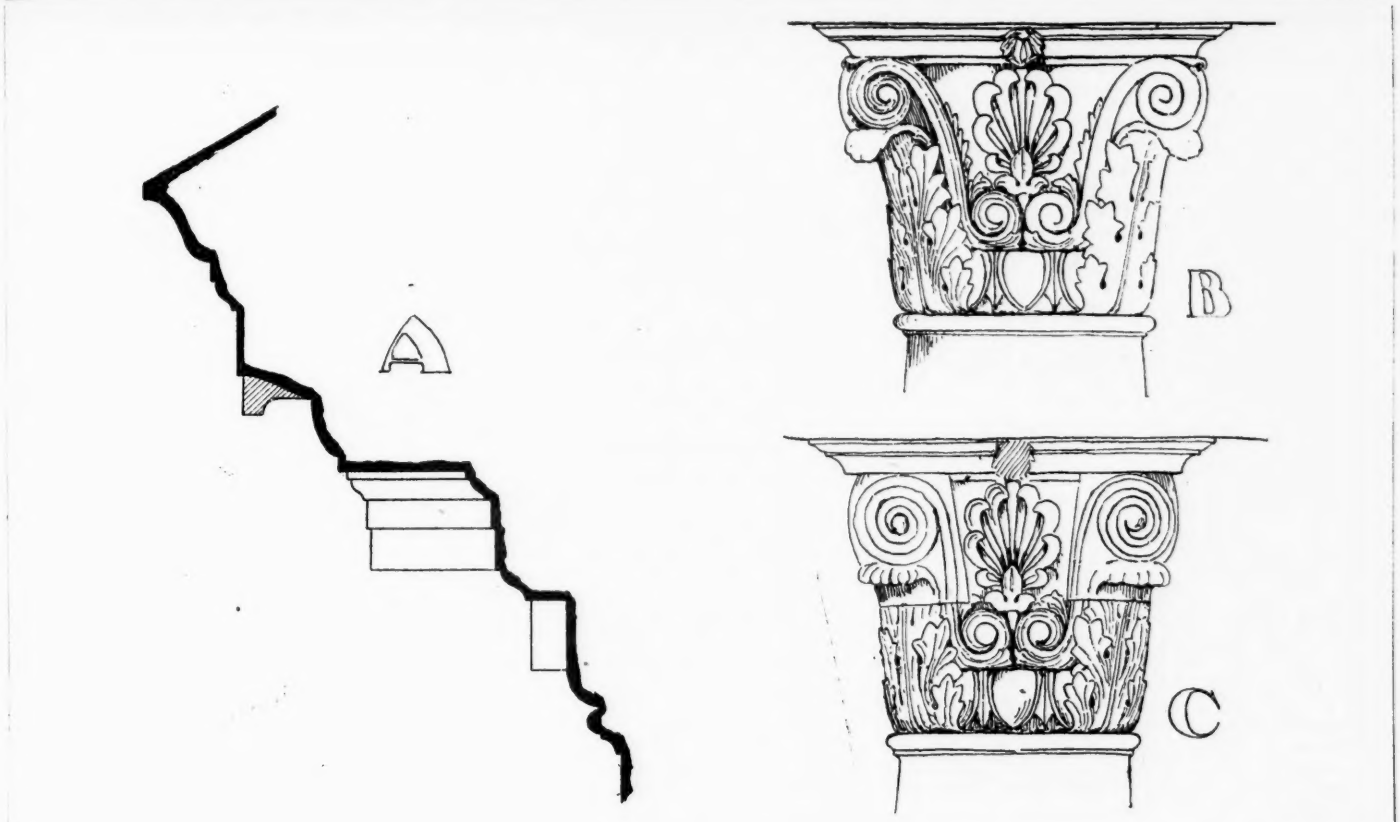
Finsbury, Central.—A building on plot No. 42 of the Council's land in Rosebery-avenue, to abut upon Garnault-mews (Mr. L. Solomon for Major Arnold).—Refused.

Height of Building and Construction.

Bermondsey.—A water-tower by the raising of the enclosing walls of a staircase between the north and west wings at Grange Mills, Grange-road, Bermondsey, which tower would exceed 80 ft. in height, and the walls of which would be of less thickness than required by the Act (Messrs. Gordon & Gunton for Messrs. Ross & Co.).—Refused.

*** *The recommendations marked † are contrary to the views of the local authorities.*

BUSINESS PREMISES, ABERDEEN.—A new block of buildings has been erected at 369, Union-street, for Messrs. J. & A. Ogilvie. The architect is Mr. W. Kelly, and the contractors:—Mason work, Mr. Alex. Cheyne; joiner work, Messrs. Hendry & Keith; plasterers, Messrs. Scott & Son; iron beams, Messrs. Abernethy & Co.; slater, Mr. Forbes Morrison; plumber, Mr. A. B. Robertson; painter, Mr. John White; electrical engineer, Claud Hamilton, Ltd.; elevator arrangements, Otis Co.; heating, Messrs. M'Kenzie & Moncur, Edinburgh. The shop fittings were carried out by the workmen employed by Messrs. J. & A. Ogilvie.



BOOKS RECEIVED.

THE STORY OF ARCHITECTURE. By P. Leslie Waterhouse. (Geo. Newnes. 1s.)

THE YEAR'S ART: 1902. Compiled by A. C. R. Carter. (Virtue & Co.)

WATER AND ITS PURIFICATION. By Samuel Rideal, D.Sc. (Crosby Lockwood & Son. 9s.)

WELL-BORING: FOR WATER, BRINE, AND OIL. By C. Isler. (E. & F. N. Spon.)

THE LAW RELATING TO FACTORIES AND WORKSHOPS. By Evans Austin. Second Edition. (Knight & Co.)

ELECTRIC WIRING AND FITTING. By C. V. Drysdale. (R. J. Bush. 3s.)

A DICTIONARY OF ARCHITECTURE AND BUILDING. By Russell Sturgis, A.M., Ph.D., and others. Third and concluding volume. (Macmillan & Co.)

PRACTICAL EXERCISES IN MAGNETISM AND ELECTRICITY. By H. E. Hadley, B.Sc. (Macmillan & Co.)

SANITARY ENGINEERING: A PRACTICAL MANUAL. By Francis Wood, A.M.Inst.C.E. (Charles Griffin & Co. 8s. 6d.)

Correspondence.

LIVERPOOL CATHEDRAL.

SIR,—I will respect Mr. Scott's desire that no further questions should be asked of him, but it is necessary for me to make some observations upon his letter, lest a false impression should arise were I not to do so.

Mr. Scott may or may not be right in thinking I have "not given much study to the St. James's Mount site." It is all a question of degree. But at least I seem to have given more study than Mr. Scott has done, for I presume he will not intentionally overstate or understate the measurements which appear in his letter, as for instance the following, viz.: (*a*) the belt of cemetery is only about 23 ft. wide, and not "some 30 ft. wide."

(*b*) The drop beyond the terrace wall is about 8 ft., and not about 6 ft.

(*c*) The path beyond the terrace wall is about 12 ft. wide, and not about 15 ft. wide.

(*d*) The "rapid fall" of ground begins at about 37 ft. from the more southerly part of the site, and at about 14 ft. from the more northerly part of the site, and not at about 45 ft., as Mr. Scott describes it; whilst the "cemetery proper" commences immediately adjoining the site, and not, as Mr. Scott describes it, beyond the "rapid fall."

(*e*) The so-called "upper terraces" are all part of the "cemetery proper," and are very fully occupied by graves, and there are not therefore "about 40 ft." of "upper terraces" available for building purposes; and, moreover, the unstable nature of the "terraces" would in any case necessitate their removal to the depth of the lower part of the cemetery, about 45 ft. to 50 ft. below the proposed site, were it desired to erect a massive building upon the site of them.

(*f*) I never stated that "the cemetery dropped 40 ft. to 50 ft. immediately beyond the boundary of the site."

As regards the numbered clauses of Mr. Scott's letter, I have to remark:—

1. That the cost of the foundation works at St. James's Mount site is estimated to be far in excess of additional land which might be required in the vicinity of Monument-place site, even "at a price!"

2. The tram lines would not be nearer to the Cathedral were it built on Monument-place site than they now are to St. George's Hall.

6. In Mr. Scott's letter in your issue of the 4th inst. he wrote, "the site is very open as your plan shows, the cemetery running the whole length of it to the east, while there is ample space to the north and south;" and I leave it to your readers to judge whether my question, No. 6, is not a fair one to ask, even in the light of Mr. Scott's subsequent letter, and to say whether they do not think that every one who had not actually seen the site would suppose, from Mr. Scott's earlier observations, that the cemetery and the site were upon the same level. The remainder of this clause I have dealt with above.

8. Mr. Scott did not previously exclude "solid shop property" from the influence of a Cathedral; but, in any case, Monument-place site is not "a district of solid shop property."

The remaining clauses either "beg the question" or support the views of the Petition Committee, and do not therefore require comment from me.

T. MYDDELTON SHALLCROSS,
Hon. Sec. *pro tem.*
Liverpool Cathedral Petition Committee.

SPOILING A BUILDING OF COCKERELL'S.

SIR,—One of the late Professor Cockerell's masterpieces, the Liverpool, London, and Globe Insurance building, Dale-street, Liverpool, is now being "restored" (*sic*) in a manner which the following sketches will, I hope, make clear.

Sketch A indicates the profile of the main cornice of the building from which the part hatched has been cut away for the whole length of the cornice, so that it now has the profile of the thick black line.

Sketch B is one of the capitals of the main order, enriching the upper part of the principal facade, and is one of those few remaining that have so far not been touched.

Sketch C is a similar capital, "restored." Six have already been so treated.

The work has been in progress for some time past, but as it has always been carefully screened from sight with sheets, the extent of the vandalism is only just beginning to appear, and to the casual passer-by in the street below is even now not very noticeable, as great care has been taken to wash over the new work and stone surfaces with a black mixture to give it an appearance of age.

As the building is the property of one of the wealthiest corporations in Liverpool, who, I am sure, are proud to have in their keeping one of Liverpool's greatest adornments, it is hard to understand the motive of such regrettable treatment; and one can only conclude and hope that it is the want of knowledge of what is actually taking place that prevents them from at once issuing instructions for this vandalism to cease, and, further, that all those capitals already mutilated should be reinstated in an efficient and capable manner, and, if impossible to reinstate, replaced with careful copies of the originals. The mutilation of the cornice is however, I am very much afraid, irremediable.

I may add that, not having access to the building, my sketches had to be made from a distance, but with aid of a powerful field glass.

ARTHUR E. NUTTER.

Liverpool, January 11, 1902.

The Student's Column.

DRAINAGE AND PRIVATE SEWAGE-DISPOSAL.

CHAPTER 4.—THE LAW IN LONDON (*Continued*).

THE legal decisions as to whether a sewage-conduit in the Metropolis is a "combined drain" or a "sewer" are somewhat conflicting, but one of the principal points of distinction appears to be whether, as a matter of fact, the conduit is laid in a public thoroughfare (in which case it is probably a "sewer") or in ground over which the public have no rightful way (in which case it is probably a "combined drain").

This view is to some extent confirmed by the case of Pilbrow *v.* Vestry of St. Leonard's, Shoreditch. Two blocks of tenements were separated from each other by a yard, which had a railing and gate at one end and a blank wall at the other. The single door of one block was entered from this yard, but that of the other block from a public street. An ash-pit was used in common by the tenants of the two blocks. Lord Esher, in delivering judgment, held that the conduit laid in the yard and receiving the drainage from the two sets of tenements was a combined drain and not a sewer. He seemed to think that the ashpit was unnecessary to the decision, the private yard being the uniting factor, and that, if this yard had been a thoroughfare, it would have divided the premises into two distinct buildings.

The Lowther Arcade case (Vestry of St Martin-in-the-Fields *v.* Bird) points in the same direction. The common conduit laid in the arcade and receiving the drainage from the shops on both sides was held to be a sewer, although the arcade was roofed over. The determining factor in the decision appears to have been that the public had unrestricted leave to pass through the arcade during certain hours of the day (Sundays excepted).

In the case of Andrew *v.* St. Olave's Board of Works (1898, 1 Q.B., 775) the plaintiff sought

to recover from the Sanitary Authority the cost of repairing the single drain which carried away the drainage from two adjacent houses. Under Section 4, Sub-Section 1, of the Public Health (London) Act, 1891, the Sanitary Authority had served a notice on him requiring him to abate a nuisance* in connexion with this drain. Believing that the combined drain had been authorised by an order of the Sanitary Authority, and that in consequence he was liable for its repair, the owner executed the necessary works. On finding that the combined drain had not been authorised by any such order, he brought an action against the Authority for the recovery of the costs and expenses which he had incurred. It was held (1) that as non-compliance with the notice would have rendered him *primâ facie* liable to a penalty under Section 4, Sub-Section 4, of the Act of 1891, he was practically compelled to do the work, and that he could subsequently recover the expenses as money paid at the Sanitary Authority's request: (2) that the "expense of carrying the order into effect" mentioned in Section 11 includes the expenses of doing work in obedience to abatement notice, and that consequently the owner, *whether he was compelled to do the work or not*, could under that section recover the expense from the Sanitary Authority as the persons by whose default the nuisance was caused. The words which we have italicised seem to open up a wide field for private enterprise in respect of the abatement of public nuisances.

The case of Green *v.* Vestry of St. Mary, Newington (1898, 2 Q.B., ch. 1), raises a different question. Four houses were drained in 1874 by a combined operation under an order from the vestry. Subsequently, without the knowledge of the vestry or of the owner of the houses, a drain from the stable of an adjoining house was connected with the combined drain. A nuisance arose in connection with the drainage of the houses, and the vestry served a notice on the owner requiring him to abate the nuisance. It was held that the unauthorised connexion of the drainage from the stable with the drain from the four houses converted this "drain" into a "sewer," and that therefore the owner was not liable to abate the nuisance.

3. *Drainage Rights.*—The owner or occupier of premises has the right of using the public sewers for the reception of the drainage from his premises, but the conditions are more onerous in London than in the provinces. Section 61 of the Metropolis Management Amendment Act, 1862, repeals Section 77 of the 1855 Act, and in lieu thereof provides that "no person shall make or branch any sewer or drain, or make any opening into any sewer vested in the Metropolitan Board of Works, or in any vestry or district board, without the previous consent in writing of such board or vestry." If such consent is obtained, any person may at his own expense make the connexion, but the drain itself and the method of communication must be "in all respects as the board or vestry shall appoint," and payment must be made for the right of connexion in places "where any contribution to the cost of a sewer is payable in respect of drainage into the same." The maximum penalty for an offence against this section is 50*l.*, and the board or vestry may cut off the connexion or reconstruct the work, and recover the expenses from the offending person.

The payment referred to in the preceding paragraph is defined in Section 80 of the 1855 Act and Section 59 of the 1862 Act. By the former section payment must be made for the right of drainage into sewers built between September 3, 1813, and December 31, 1855, "at the expense of any person or body other than any Commissioners of Sewers." The payment must be made by the owner of the drained premises to the vestry or board in whom the sewer is vested, and the vestry or board will then hand the money over to the person or body at whose expense the sewer was built. Section 59 of the 1862 Act extends this provision to similar sewers vested in the Metropolitan Board, and to sewers constructed, or to be constructed, by private persons or bodies subsequent to January 1, 1856. Section 78 of the 1855 Act authorises a vestry or board, wherever it is necessary to open any part of the pavement or any street or public place for drainage purposes, to make the communication between the drain and sewer, and to construct such part of the drain itself as shall be under or in any street, and to recover the expenses from the owner of the premises.

By Section 69 of the Act of 1855 a vestry or board may not only alter, but also discontinue, close up, or destroy any sewer vested in them. In the latter case, the vestry or board must provide some other sewer or drain, and connect the old private drains to it; and whether the old sewer is altered or a new sewer substituted, the vestry or board "may contract or otherwise alter" the private drains communicating with the sewer, or may close up or destroy the private drains and provide new drains, "but so that, in every case, the altered or substituted drain shall be as effectual for the use of the person entitled thereto as the drain previously used."

The case of the Vestry of St. Martin-in-the-Fields *v.* Ward (1897, 1 Q.B., 40) turned on this section. The vestry had constructed a new sewer in substitution for an old one into which a house was previously drained, and it became necessary to make a new drain from the house. It was held that Section 73 (see below) of the M.M. Act, 1855, did not apply, and that the vestry could not recover from the owner of the house the expense of making the new drain.

4. *Drainage Duties and Responsibilities.*—Section 73 of the Metropolis Management Act, 1855, requires old and new buildings which are in any part within 100 ft. of a suitable sewer to be drained into such sewer by means of covered drains "of such materials, of such size at such level, and with such fall as shall be adequate." The provisions are, however, more extensive than those in the corresponding section (23) of the Public Health Act, 1875, but as the details are now in the main covered by regulations and by-laws, they need not be here particularised. Section 75 renders it illegal to occupy any house or building newly-built or rebuilt, unless drains, &c., have been constructed to the satisfaction of the surveyor of the vestry or board.

Sections 72 to 75 empower the vestry or board to cause an inspection to be made of drains, cesspools, &c. and (after notice) to reconstruct defective works; the provisions are in the main similar to those contained in Section 41 of the Public Health Act, 1875, already described. Sections 40 and 41 of the Public Health (London) Act, 1891, deal with the same subject, and ought to be read in this connexion.

Buildings may not be erected "in, over, or under any sewer vested in the Metropolitan Board of Works, or in any vestry or district board, without their consent first obtained in writing." The penalty is demolition of the building and payment of the expenses incurred.

The Metropolis Management Amendment Act, 1862 (Section 52) authorises the vestry or district board to apportion the total cost of sewering new streets among the abutting owners. In the case of streets in which, before the construction of the new sewer, "there had been no sewer, or only an open sewer, but where sewer rates have been levied previously to such construction," the vestry or board must bear part of the cost of the new sewer. Section 49 of the same Act requires seven days' notice in writing, accompanied by a plan, to be given to the vestry or district board before making or branching any drain into a sewer vested in the Metropolitan Board of Works.

The Metropolis Management Amendment Act, 1890, contains two important sections relating to sewers and drains. Section 4 provides that "any person making any sewer, or branching any sewer or drain into any sewer vested in the Council,* without the approval in writing of the Council first had and obtained, or otherwise than in accordance with a plan and section thereof approved by the Council, or causing any such sewer or drain to be so made or branched, shall be liable to a penalty not exceeding fifty pounds." The Council may, by notice in writing, require the owners to reconstruct all work done in contravention of the foregoing conditions, or may re-execute the work and recover the cost from the owners. Section 5 contains similar provisions with regard to sewers vested in any vestry or district board. Under both sections the owners may, in their turn, recover from the persons who improperly carried out the work any costs and expenses paid to the Council, vestry, or district board.

The Public Health (London) Act, 1891, Section 42, provides that "if a water-closet or drain is so constructed or repaired as to be a nuisance or injurious or dangerous to health, the person who undertook or executed such construction or repair shall, unless he shows that such construction or repair was not due to any wilful act, neglect, or default, be liable to a fine not exceeding twenty pounds." A proviso is, however, added to the effect that the person charged with an offence under this section may cause "his agent, servant, or workman" to be brought before the Court at the time appointed for hearing the charge, and that the Court may decide whether the fine shall be imposed on the principal or on his subordinate.

The drainage of "underground rooms" is referred to in the same Act (Section 96, I., *d*, *f*, and *g*).

The London Building Act, 1894, Section 122, prohibits the erection or adaptation of "any building to be used wholly or in part as a dwelling-house" upon land "of which the surface is below the level of Trinity high-water mark, and which is so situate as not to admit of being drained by gravitation into an existing sewer of the Council," except with the permission of the Council and in accordance with the regulations which the Council may make. Appeal may, however, be made to the Tribunal of Appeal if objection is raised to the Council's decisions. Under this section the Council has made a regulation to the effect that the underside of the lowest floor must be at such a level as not to be liable to flooding, and that the building must be "efficiently and properly drained" to the satisfaction of the Council's engineer, either into a local sewer or into a main sewer of the Council.

5. *Sewage Disposal.*—Section 75 of the Metropolis Management Act, 1855, specifies that, in the case of buildings more than 100 ft. from any sewer ("existing or intended to be constructed"), the drains may discharge into "such covered cesspool or other place, not being under any dwelling-house, as the vestry or board shall direct." Since the passing of this Act, cesspools have been more stringently regulated. The Amendment Act of 1862 (Section 66) extends the distance between building and sewer to 200 ft., and stipulates that the cesspool shall not only be covered, but also watertight, and that it shall not be "within such distance from a house as the vestry or board shall direct." The section also gives to the Authority the same powers of enforcing the proper construction and maintenance of cesspools as it already possessed with regard to drains.

More recently the use of cesspools has been still further discouraged, and the by-laws now in force will be referred to in Part III.

6. *By-laws and Regulations.*—The difference between by-laws and regulations was briefly stated in Chapter I. The new drainage by-laws adopted by the London County Council will be considered in Part II. These are framed chiefly under the powers granted by the Metropolis Management Act, 1855. By-laws relating to water-closets, earth-closets, privies, ashpits, cesspools, and receptacles for dung, "and the proper accessories thereof," are made under Section 39 of the Public Health (London) Act, 1891, and apply to works "constructed before or after the passing of this Act."

THE LONDON BUILDING ACT, 1894:
STAIRCASES IN PUBLIC BUILDINGS.

THE Tribunal of Appeal under the London Building Act sat at the Surveyors' Institution, Great George-street, Westminster, on Tuesday, to hear an appeal by the Rowton House, Ltd., against the requirements of Mr. Arthur Crow, District Surveyor for Whitechapel, in the matter of the construction of concrete staircases at the building to be known as Rowton House, Fieldgate-street, Whitechapel, under Section 78 of the Act. The members of the Tribunal sitting were Messrs. Penfold (Chairman), A. H. Hudson and E. A. Gruning.

The appellants were represented by Mr. William Morris, solicitor, and the respondent by Mr. J. F. Andrews, from the Solicitor's Department of the London County Council.

It appeared from the opening statement on behalf of the appellants, that Rowton House, Limited, is engaged in erecting another building intended for the accommodation of the working classes at Fulgate-street, Whitechapel. For the purposes of the London Building Act, the Rowton Houses—of which

* The definitions of "general nuisances" will be found in Section 2 of the Public Health (London) Act, 1891, and of "particular nuisances" in Section 16. The principal powers of Metropolitan Sanitary Authorities in respect of the abatement of nuisances are stated in Sections 3 to 15 and 17 to 22. Offences against these sections may be punished by penalties.

* That is to say, the London County Council.

this is the fourth in London—are classed as public buildings, and as such, the construction is to be to the satisfaction of the District Surveyor, under section 78 of the Act of 1894. The District Surveyor for Whitechapel (Mr. Crow) took exception to the mode employed in the building of the concrete staircase, and, in pursuance of his powers, served a notice requiring the respondents to provide strings under the unsupported ends and the stairs throughout the building. The method of construction followed was, it was explained, as follows :—The steps are span-drilled steps, jointed with square ends, pinned 9 in. in the wall. They are cast in moulds, and have two 1½ in. angle irons on each step. The tread and nose of the step are formed of granite chippings and Portland cement 2 in. thick in the proportion of two of chippings to one of cement. This portion is filled into the mould first, and the remainder of the step filled in with fine coke breeze in a proportion of three of breeze to one of cement. The quarter space landings are carried by two 3 by 3 steel joists to each landing, carried to within 4½ in. of the external face of the wall, and the concrete of the landings is pinned into the wall. The landings are of breeze and Portland cement in the same proportion as before, with a facing of granite chippings.

Mr. Morris, for the appellants, contended that the process followed out met all the requirements of the Act, and absolutely secured those who used the building from accident. The staircases of three similar houses had already been erected on these lines, and no objection was taken by the District Surveyors in the metropolitan boroughs concerned.

Mr. H. B. Measures, F.R.I.B.A., architect of the building, and Mr. G. J. Earle, clerk of the works, gave evidence in support of the appellants' case. The latter was cross-examined at length by Mr. Andrews as to the breaking-strain of the stairs in question.

Mr. Andrews, for the defence, pointed out that there might be latent defects in the staircase, and that for the protection of persons who resorted to this class of building, the contingency of a panic should be taken into account. It was intended to accommodate 800 persons, and, assuming that one staircase out of three was to become involved, it would leave the other two to provide the necessary egress for the 800 persons who might be in a state of panic, and thereby cause a very great strain to be put upon the steps. Sections 68 and 80 of the Act seemed to contemplate that stairs in public buildings should be supported at both ends. It was reasonable to look upon this building as in the nature of the class of buildings contemplated by Section 80 of the Act. Therefore the District Surveyor could not take the responsibility of passing the construction of the stairs without strings at the outer end. He submitted that the Tribunal should not take the responsibility of passing the plan when it had been admitted in cross-examination that the strings would afford an additional safeguard against the failure of the stairs from extraordinary stress.

Mr. Crow, the District Surveyor for Whitechapel, giving evidence in support of this contention, declared that the projection of 4 ft. 6 in. was too great for this form of stairs, and that the steps were liable to snap off close to the wall. Moreover, coke breeze, which was the component part of the steps, was not hard enough to stand a self-compressible strain. Portland cement, too, expands in the course of setting, and that action extends over many months. As, therefore, the steps would be composed of two different compositions the expansion would be unequal. He also gave evidence as to the load-bearing capacity of the stairs, stating that there might be a load equivalent to 10¼ cwt. on each step, and submitting that the steps ought to be calculated for a breaking strain of at least 50 cwt.

Mr. W. G. Perkins, of the London County Council Architect's Department, also gave evidence as to the stress that should be provided for in steps of this construction.

Eventually, the Tribunal adjourned the further hearing of the appeal with the view to personally viewing the staircase in question.

CROWN LANDS AND HOUSES IN LONDON.

MESSRS. E. STAFFORD HOWARD and J. F. F. Horner, Commissioners of His Majesty's Woods, Forests, and Land Revenues, in their report for the past year, just presented to Parliament, mention that since 1873 ground rents have been purchased by them to a considerable extent as investments for capital monies; and out of the monies invested in purchasing estates, &c., a total sum of about 1,982,336*l.* has been expended in buying ground rents, while further sums amounting to about 326,362*l.* have, since the same date, been invested in the purchase of other house property in London. The ground rents so purchased amounted to 75,909*l.* per annum, and the rental obtained for the houses, &c., purchased and let otherwise than at ground rents amounted to 12,682*l.* per annum. The investment of about 2,308,698*l.* has, therefore, produced an average return of nearly 4*l.* per cent, and, in addition to this, the capital values of the properties acquired have now very largely increased. In the schedule of messuages, lands, hereditaments, &c.' belonging to the Crown the following are shown as being in the county of Middlesex :—

Houses and Other Buildings Let at Rack-rents, or at Rents which have been Fined Down from Rack-rents—Nine houses at Hampton Court, producing in the year 1900-1901 a rental of 654*l.* 4s. 7d.; fourteen houses at Kensington, 1,543*l.* 10s.; 329 houses in various parts of London, 70,408*l.* 16s. 4d. (the leases of these 329 houses will expire at various periods; the receipts include fines amounting to 755*l.* taken on the renewal of four of the leases); one house, Rolls Estate, 155*l.*

Land Let for Building Purposes, including Land Let at Ground Rents which have been Purchased.—Land in the City of London, with 129 houses thereon, built by the lessees, producing rents, &c., in the year 1900-1901, amounting to 48,645*l.* 16s. 6d.; land let at Hampton Court, with four houses erected thereon by the lessees, producing 26*l.* 9s. 3d.; land let for building at Kensington, with with eighty-five houses and some stabling, &c., built by the lessees, producing 8,522*l.* 17s. 8d.; land let for building at Millbank, with 397 houses thereon built by the lessees, producing 2,045*l.* 14s. 8d. (the leases will expire in 1943); land let for building in New Oxford-street, with eighty houses thereon built by the lessees, producing 4,890*l.* On (the leases will expire for the most part about 1925) land let for building at Victoria Park, with 649 houses thereon built by the lessees, producing 3,126*l.* 6s. 6d.; land let for building in Regent-street, Regent's Park, Strand, and other parts of London, with 2,933 houses thereon built by the lessees, producing 163,952*l.* 14s. 7d. (these leases will expire at various periods, for the most part about 1920); land on the Rolls Estate let for building with three houses thereon built by the lessees, producing 1,316*l.* The following is a schedule of London leases granted by the Commissioners in the year ending March 31, 1901.

No. 1, Chapel-place, Delahay-street, Westminster.—Lease granted to the Commissioners of Works and Public Buildings for 20½ years from October 10, 1900, at a yearly rental of 343*l.* 6s., progressively decreasing in subsequent years to 243*l.* 10s. for the last year of the term.

No. 161, High Holborn.—Leased to William James Webster for twenty-one years from October 10, 1895, at a rental of 65*l.*, the lessee to incur certain expenditure upon the premises and to insure the same against fire for 1,200*l.* at the least.

No. 7, Lawrence Pountney-hill.—A messuage leased to Hugh Charles Knowles for eighty-two years from September 29, 1898, at a rental of 350*l.*, subject to certain expenditure by the lessee on the buildings and to the surrender of a former lease which would have expired in 1915.

New Burlington-place.—A messuage and buildings, Nos. 13 and 14, New Burlington-place (formerly Old Burlington-mews), leased to the Mural and Decorations Syndicate, Limited, for twenty-one years from July 5, 1899, at 225*l.* for the first year, 300*l.* per annum for the next six years, and 325*l.* per annum thereafter.

Athenæum Club, Pall Mall.—Leased to Baron Avebury, Sir F. A. Abel, and Sir M. E. Grant-Duff, for sixty years from April 5, 1899, at a rental of 1,800*l.*, subject to the surrender of the lease (at a rental of 327*l.* 12s. and 33*l.* in lieu of Land Tax redeemed by the Crown), which would have expired by effluxion of time on April 5, 1927.

Regent's Park.—A piece of land in Regent' Park, containing about 12 a. 3 r. 29 p., with the messuage thereon known as St. Dunstan's Villa, leased to Baron Aldenham for 24½ years from April 5, 1900, at 256*l.* 16s. 7d. per annum. These premises were previously held under leases which would have expired by effluxion of time on October 10, 1924, at rents amounting together to 256*l.* 16s. 7d. per annum. On the application of the representatives of the original lessees and Lord Aldenham, surrenders thereof were accepted, and a new lease in lieu granted to his lordship direct on the whole for the unexpired residue of the terms of the surrendered leases.

Regent-street, &c.—A messuage and buildings, No. 15, Regent-street, Nos. 11, 12, 13, and 14, Babmae's-mews, and No. 4, Well-street, leased to the Junior Army and Navy Stores, Ltd., for sixty years from April 5, 1900, at a yearly rental of 3,114*l.*, and the buildings to be insured against fire to at least three-fourths of the value. The part of the premises known as No. 15, Regent-street, was last let for a term which would have expired by effluxion of time on April 5, 1918, at rents (inclusive of Land Tax redeemed by the Crown) amounting to 293*l.* 13s. 3d. per annum. That lease was surrendered as from April 5, 1900, pursuant to an arrangement for the grant of a new lease to the Junior Army and Navy Stores, Ltd., of the demised premises; together with Nos. 11, 12, 13, and 14, Babmae's-mews, and No. 4, Wells-street, which were acquired by the Crown by purchase from the Junior Army and Navy Stores, Ltd., and from John Thomas Christopher, and others, respectively.

Regent-street and Glasshouse-street.—A messuage known as the Imperial Restaurant, Nos. 60 and 62, Regent-street, and Nos. 7 and 9, Glasshouse-street, leased to William Godsell Curnick and Arthur Herbert Curnick for twenty years from January 7, 1899 (to be enlarged to the full term of eighty years from that date upon the performance of certain covenants), at a rental of 300*l.* for the first year, 500*l.* for the second year, and 810*l.* per annum thereafter, subject to the erection of buildings by the lessees and the surrender of a former lease (at 185*l.* 2s. 9d.) which would have expired in January, 1918.

Wells-street.—A messuage known as the "Three Crowns" public-house, No. 3, Wells-street, leased to Watney, Reid, & Co., Ltd., and Alfred John Banyon for ten years from April 5, 1900, at a rental of 100*l.* per annum, subject to the surrender of an expiring lease (20*l.* 5s. per annum), the expenditure of certain money upon the premises by the lessees, and the insurance of the buildings against fire to the extent of 1,500*l.*

Whitcomb-street.—A messuage and stabling, No. 15, leased to Ellis Brammall, jun., for twenty-one and a half years and eleven days from March, 1898 (but determinable by the lessee on April 5, 1905, on six months' notice), at 200*l.* per annum.

Whitehall-place.—A messuage, No. 3, leased to the Commissioners of Works and Public Buildings for nineteen years and one day from July 5, 1900, at 300*l.* per annum, subject to the surrender of the former lease (63*l.* per annum), which would have expired on April 5, 1912.

GENERAL BUILDING NEWS.

CHURCH, NEW HOLLAND, NORTH LINCOLNSHIRE.—The Bishop of Lincoln opened a new church on the 15th inst., at New Holland, which is in the parish of Barrow-on-Humber. Christ Church, as it is called, consists of a nave 67 ft. by 28 ft., and a chancel 30 ft. by 21 ft., with provision for a tower 17 ft. square on the north side. It is built entirely of red brick in the Perpendicular style, and roofed with Staffordshire tiles. Internally the roof is of open timber panelled under the rafters. The seats are all open and of stained wood, and there is accommodation for 317 persons. Mr. C. Hodgson Fowler, F.S.A., was the architect, and the general contractor was Mr. A. Lyons, of Norton, and the clerk of works, Mr. A. Gordon.

CONGREGATIONAL CHAPEL, LINCOLN. — On the 15th inst. the memorial stones were laid of the new Congregational Chapel in course of erection at South Bar, Lincoln. The chapel has a frontage to High-street. It is in the Perpendicular style, and it will be 35 ft. wide and 57 ft. long on the ground floor, and extending backwards from the gallery about 11 ft., making a total length of 68 ft. On the north side there is an aisle about 9 ft. wide, and between that and the main arch are stone pillars and arches. The entrances to the ground floor comprise an outer and two inner vestibules. There is a separate entrance with a stone staircase to the gallery, which is at the end only, and a space is provided for an organ at the east end of the aisle. The choir seats are placed on each side of the rostrum. The edifice is built of red brick, with stone dressings, the windows being glazed with cathedral glass, in lead quarries. The roof timbers will be of pitch pine, stained and varnished, and will have plaster panels between, and all the internal woodwork will be of pitch pine. The building will be heated by hot water, and will accommodate 450 persons. The total expenditure involved is about 3,000*l.* The architect is Mr. J. H. Cooper, Lincoln, and the contractors Messrs. Mawer Bros., Louth.

SCHOOL, STOW-ON-THE-WOLD, GLOUCESTERSHIRE.—The new schools for girls and infants built for the School Board have just been opened. The shape of the site necessitated the adoption of a two-storied building—the girls being placed upon the upper floor and the infants upon the ground floor. The girls' department is approached by a separate entrance and an easy staircase, the accommodation being as follows :—Schoolroom, 44 ft. by 22 ft.; classroom, 20 ft. 6 in. by 20 ft.; cloakroom, 16 ft. by 12 ft.; lavatory, 12 ft. by 12 ft. The infants' department is similar to that provided for the girls. The exterior is faced with local stone, and the roof is covered with stone slates from the Eyford Hill quarry, some few miles away. The accommodation gives a total of 290—viz., 154 infants and 136 girls; the cost of the building being 3,264*l.* Mr. H. W. Chatters, architect, of Cheltenham, has designed and superintended the erection of the buildings, which have been erected by Messrs. George Howman & Co.

PROPOSED WORKHOUSE, FYLDE, LANCASHIRE.—On the 15th inst. a special meeting of the Fylde Board of Guardians was held to consider the advisability of proceeding with the erection of the proposed new workhouse. In the course of the proceedings Mr. Heywood, of Messrs. Heywood & Harrison, Accrington and Lytham, the architects, explained the plans. It was ultimately agreed to erect the buildings.

COUNCIL HOUSE, YARDLEY, NEAR BIRMINGHAM.—The new Council House and Public Offices at Sparkhill, for the parish of Yardley, were opened on the 15th inst. The building, including site and equipment, which has been erected at a cost of 16,000*l.*, adjoins the Sparkhill police-station. It is of brick, with stone dressings, and Cotswold stone tiled roof. There is a gable at each end, whilst the central portion is relieved by a circular bay running up to the roof. At the north end is a clock tower, about 80 ft. high. There are two entrances at the

front. One communicates with the main staircase leading to the Council Chamber, and the other is adapted for visitors to the surveyor's department. On the ground floor there are eight offices. The rate-collectors will be accommodated in two offices. A stone staircase leads to the first floor, and opens on to a corridor, divided into bays by piers and panelled ceiling, and running the whole length of the Council Chamber and committee-rooms. The chamber measures 50 ft. by 27 ft. The roof is open timbered, and the apartment is lighted by stone mullioned windows and leaded lights facing Stratford-road, and a line of clearstory windows, filled with stained glass, on the opposite side. Entering from Court-road is the depôt, comprising fire-station, mortuary, stabling, workshops, messroom for the firemen, &c. Mr. A. Harrison was the architect.

WHITWORTH HALL, OWENS COLLEGE, MANCHESTER.—The Whitworth Hall building, just completed, occupies the south-east angle of the Owens College site, and, so to speak, completes the College buildings. Adjoining it on the north is the large tower which has for many years been the principal feature of the college, and on the west stands the Christie Library, which is the last part of the college previously completed. The site is peculiarly adapted to the nature and requirements of the new building, for, being bounded as it is by streets on two sides—viz., Oxford-street on the east and Burlington-street on the south—the entrances are very commodious. The Whitworth Hall proper is confined to the upper story, the ground floor being occupied by a number of rooms of relatively small size. These are suitable for various purposes. Most of the rooms are about 18 ft. by 17, and others are larger. One of them is intended to serve, if necessary, as a kitchen in connection with any banquets that may be held in the hall above. A wide carriage archway spans the space between the new hall and the older buildings. Out of this archway access can be obtained—northward into the old buildings, southward into the new. Immediately within the entrance of the new building is a hall with columns, out of which a wide corridor leads between the above-mentioned rooms into the staircase hall, which is also approached from the street entrances in Oxford-street and Burlington-street. The staircase, which is screened from the hall by an arcade, divides right and left, and leads in the first instance into the floor of the building. Further flights of the staircase, which are confined within the angle-towers on the south end of the structure, lead not only to the raised seats at the back of the hall, but also to the galleries at the higher level. The width of the hall is 50 ft., and the total length is about 130 ft. Not all of the length, however, is visible, for the north end is partially blocked by the great stage, which is surmounted by galleries and by the large organ. The most striking feature of the hall is its roof. This is constructed in oak, and is a modification of what is known as the hammer-beam roof. Its construction has necessitated the use of buttresses, which pleasantly break up the long length of the building, and are in harmony with the buttresses of the earlier museum buildings. The principals, which are in the form of pointed arches, are sustained at either side of the hall by six granite columns. The windows at the sides have two lights each, and are divided in their height by transoms. These windows, as well as the large window at the south end, are filled with coloured glass, but the latter is further enriched by the addition of arms, chiefly those of benefactors of the college. All the visible woodwork is of oak. The hall is not fitted with fixed seats, as the variety of uses to which it will be put would render such an arrangement impracticable. The stone used—Minera stone—is the same as that which has been employed in the rest of the college buildings, and the style of the work is more or less identical with that which has hitherto been executed from the designs of Mr. A. Waterhouse, R.A. The interior height of the hall from the floor to the apex of the roof is 65 ft. The towers at the south end—which have naturally been kept low so as not to unpleasantly rival the main tower of the college—rise only to a height of 100 ft. above the pavement. Many firms have been engaged in the construction. The general contractors were Messrs. Southern & Sons, under whom Messrs. Corcoran carried out the masonry. Mr. John Grundy has done the heating, the wrought-iron work was by Messrs. Hart, Son, Peard, & Co., and the stained glass by Mr. George Wragg. Mr. Oppenheimer has executed the mosaic floors, and the whole of the work has been under the supervision of Mr. William Rutherford, permanent clerk of the works at the College. Mr. Paul Waterhouse has been mainly instrumental in carrying out his father's ideas.—*Manchester Courier.*

PUBLIC OFFICES, FELLING, DURHAM.—This building, the foundation-stone of which was laid on the 20th inst., is intended to provide accommodation for the various public bodies and officials of the district. The site is situated on Sunderland-road, and the building will have a frontage of about 130 ft. to the roadway. The main entrance-hall, which is 10 ft. wide, will be approached by a flight of steps from the roadway, and a clock tower will be carried up immediately over the entrance to a height of 65 ft. from the road level. Corridors branch off on either side of the main hall, and here the various offices are situated. On the ground floor are offices for the Clerk to the District Council, Clerk to the Heworth School Board, relieving officer, assistant overseer, rate collector, school attendance officer, together with large Board room for the use of the local Guardians and the Relief Committee of the Heworth School Board, with waiting-room attached. There is also a telephone-room on this floor, with an additional spare office. On the first floor, which is approached by a stone staircase, are situated the Council Chamber and Board room for the District Council and the School Board, committee-room, councillors' retiring-room, waiting-room, surveyor's offices, and rooms for the medical officer and the sanitary inspector. In the basement will be a fireproof strongroom, cellars, &c., and on the attic floor rooms are provided for the caretaker. The Council Chamber is 40 ft. long by 24 ft. wide. The committee-room will have direct access to the Council Chamber by special doors. The building will be lighted with the electric light. The erection will be entirely of stone, the walls being faced with coursed rock-faced blocks, and the dressings will be moulded and polished. The design is Italian Renaissance. The cost of the building without the site will be about 7,000*l.* The contract is let to Mr. John Wilkinson, contractor, Felling, and the architect is Mr. H. Miller, Felling.

TOWN AND COUNTY BANK, ABERDEEN.—The new branch building for the Town and County Bank, which is to be erected at the foot of Marischal-street, on the site of the present building, will be erected from plans prepared by Mr. R. G. Wilson. The chief elevations will be to Marischal-street and Regent Quay. The building will be of the Renaissance style.

SANITARY AND ENGINEERING NEWS.

ELECTRICITY SUPPLY, MANCHESTER.—The foundation-stone was laid on the 16th inst. of the Stuart-street generating station, near Philips Park. For purposes of economy, it was necessary to go outside the city proper to find ground for the station. Sub-stations will have to be established—stations at Bennett-street, Chorlton-cum-Hardy, Cheetham Hill, Denton, Didsbury, Fallowfield, Harpurhey, Moss Side, Newton Heath, Rusholme, Ardwick, and elsewhere. Dr. Kennedy, the adviser of the Corporation, has general supervision of the scheme. The first two parts of the scheme are now being carried out. The first part is based on plans and specifications prepared by Dr. Kennedy for the development of electrical energy representing 15,000 h.p. The other part is based on the plans and specifications of Mr. Metzger, the City Electrical Engineer, and it provides 10r energy representing 12,000 h.p. The buildings are steel-framed structures, the walls being filled in with brickwork. The engine-house is 114 ft. 6 in. long and 131 ft. wide and 60 ft. high, being divided into two bays of 53 ft. wide. Each bay will contain three engines of 2,500 h.p. There is also a centre bay of 25 ft., containing the condenser plant and other machinery. The boiler-house is 200 ft. long, 93 ft. wide, and 53 ft. high. The first instalment of plant will consist of twenty-four Babcock & Willcox boilers, supplying steam for engines of a capacity of 15,000 h.p. The engineering works are being carried out by Dr. Kennedy, of London, Messrs. C. S. Allott & Son, civil engineers, of Manchester, being responsible for the buildings and constructional works, which are being carried out under their supervision.

WATER SCHEME, BARNSLEY.—On the 17th inst. a Local Government Board inquiry was held at the Barnsley Town Hall relative to the application of the Town Council to borrow 120,000*l.* for purposes of water supply. There were present Alderman Raley, Chairman of the Water Committee; Mr. J. H. Taylor, Borough Surveyor; Mr. Hawksley, Consulting Waterworks Engineer, and others. Mr. Hawksley said the actual cost of the embankment would be practically 100 per cent. more than the amount originally estimated. This was due entirely to the great rise in the price of labour and materials, and it had also been found necessary to go to a greater depth in order to get a good foundation. The unexpected nature of the strata had also increased the cost. The Sheffield Corporation had taken over the obligations of Barnsley with regard to compensation water, and they had been able to reduce the area, but the capacity of the reservoir, owing to its having been deepened, would not be reduced. The estimate for the filter beds had been increased from 12,000*l.* to 28,000*l.*, though nothing had yet been done beyond the clearing of the land for their construction. The population to be supplied was 93,000.

FOREIGN.

FRANCE.—The jury in the competition opened at Albi for a new covered market have given the commission to M. J. André Michèlin, constructional engineer, of Paris. A premium has been awarded to M. Gabelle, of Marseilles.——The jury in the competition for a girl's school at Algiers have awarded the first premium to M. Darbèda, Government Architect. M. Bévia obtained the second premium, and M. Soussy the third.——The Prefect of the Seine has appointed a committee of eight to decide as to works to be admitted to the permanent art gallery to be formed at the Petit Palais. The members of this committee are MM. Bonnat, J. P. Laurens, Gérôme, Benjamin-Constant, Fremiet, Mercié, Detaille, and Carolus-Duran—the last-named appointed officially as President of the Salon. The special committee will act in concert with the Art Committee of the Paris Municipality.——The jury of the Ecole des Beaux-Arts have awarded the prize in decorative composition (Section of Architecture) to M. Portier; only a "troisième médaille," however, has been awarded. The subject was the wall of a bathroom. ——M. Alfred Boucher, the sculptor, is just completing an equestrian statue of the Shah of Persia. M. Mercié has completed the monument to Gounod, to be erected in the Parc Monceau, Paris. The bust of the composer will be placed on a marble stele at the foot of which will be grouped three figures representing the composer's three principal heroines—Mireille, Sappho, and Margaret; and by their side a figure seated at a clavecin personifies "Inspiration."——M. Delrie, the sculptor, has been commissioned to execute, for the Bibliothèque Nationale, the bust of Labrouste, the architect of the portion of the building facing Rue Richelieu, as well as of the Gallery of Engravings. The Government has also commissioned busts of various other persons concerned in the foundation of the National Library.

AUSTRALIA.—A public meeting has recently been held in Sydney at the Town Hall for the purpose of discussing the best way of securing a new Building Act for the city and New South Wales generally. The Mayor remarked that the hands of the City Council were practically tied in the matter of dealing with insanitary and dilapidated buildings, slum areas, &c., as a result of the inefficiency of the existing Act. The President of the Institute of Architects, and the President of the Master Builders' Association, spoke strongly in favour of the amendment of the law at present in force.——A return made to the New South Wales Legislative Assembly shows that the expenditure on the parliamentary buildings, Sydney, from 1891 to 1901 was 31,094*l.* ——A large Presbyterian church is about to be erected at Leura, New South Wales.——During the forthcoming recess the Minister for Works intends to expend 5,000*l.* in improvements to the ventilating and lighting of Parliament House, Sydney.——Large additions are being made to the Sydney Art Gallery buildings. They comprise the erection of the main central portico with ten Ionic columns, the inner lobby, and the vestibule entrance to the galleries. The vestibule is being constructed wholly of stone, while the niches for statuary on either end and the entrances and exits are subdivided by detached columns. Mr. W. L. Vernon, the Government Architect, is of opinion that the work already done is sufficient to show the necessity of redesigning the landscape features of the Outer Domain in its relation to the building.

MISCELLANEOUS.

PROFESSIONAL AND BUSINESS ANNOUNCEMENT.—The Albion Clay Company have removed their offices to larger premises at Members Mansions, 38, Victoria-street, Westminster, S.W.

HUDDERSFIELD MASTER BUILDERS' ANNUAL DINNER.—The annual dinner in connection with the Huddersfield and District Master Builders' Federation and Quarry Owners' Association was held at the Masonic Hall, Fitzwilliam-street, on the 18th inst. Alderman W. H. Jessop presided, and he first submitted the loyal toast. Mr. T. S. Ullathorne, in submitting the toast of "The Yorkshire Federation," remarked that for fifty years the men had been allowed to organise amongst themselves, and when there had been trouble the employers had simply been at their mercy. There had been local organisations, but what with jealousy and one thing and another they had not done much good. Owing to the action of their President, the Federation came into existence about four years ago, and it was as yet only in its infancy. The value of federation was that instead of being disunited they were now united in one body, and he hoped in a few years' time the masters would be joined together all over England. —Mr. J. Biggin (Selby), in response, urged the advisability of bringing all the sub-trades into one association. They would never have the power they ought to have, and have the things they ought until the trades were bound together in one national association. In so far with the joiners there had been no friction whatever, but there had been with the plumbers, slaters, painters, and plasterers, and there was a little jealousy and a little ill-feeling which he hoped to see put on one side, although he might say at the present time it was a very difficult problem, and a way had not presented itself for the little difficulty to be bridged over.—Mr. W. R. Thompson (Dewsbury) gave "The Huddersfield and District Master Builders' Federation and Quarry Owners' Association." After referring to the advance of the Association during the short time it had been in existence, he said the masters in Huddersfield had worked together more amicably than had those in other towns. He hoped this feeling would continue to grow, as it was necessary for the masters to become members not only of the Master Builders' Association, but of other associations interested in the

welfare of the trade. Having taken an active part in those associations for a number of years, he now saw the necessity of every section of the trade joining hands. He also urged the advisability of building up a reserve fund. Mr. L. Radcliffe, in response, also remarked upon the necessity of combination amongst the masters, otherwise the Association would not be of much good. He referred to the question which had been brought before some of the public bodies of the town with regard to the employment of certain firms who had agreed to pay standard wages. A list had been issued of the firms who had agreed to these terms, but there were a number of firms in the town who did not appear on the list, and amongst these were some of the best firms in the town. It seemed to him that it was very hard that these firms should be debarred from sending in their prices, and it might result in the ratepayers having to suffer. Mr. John Hirst (Cleckheaton) gave "The Town and Trade of Huddersfield," and Alderman Calvert and Mr. John Dawson responded. Other toasts were "The Visitors," submitted by Mr. J. H. Taylor, and responded to by Mr. Connell (Selby) and Mr. J. Berry, and "The President," by Mr. John Pyrah.

BRITISH FIRE PREVENTION COMMITTEE.—The Committee have arranged for a very important test to take place on Wednesday next with a large warehouse floor constructed entirely of Karri and Jarrah wood, the floor being constructed on the same principle as recently adopted for the large warehouses in the new Free Port at Hamburg. There will also be tests with Karri and Jarrah doors for comparison with the fire resistance of oak and teak doors. A large attendance of visitors is anticipated, including several foreign correspondents who will be specially visiting London. —It is announced that the Silver Medal which the Committee offered for the best Essay on fire-resisting materials exhibited at the International Fire Exhibition of 1901, at Berlin, has been awarded to Lieutenant Elsner, of Berlin, the assessors being Chief Officer Giersberg, of Berlin, and Mr. Edwin O. Sachs, the Chairman of the Committee. The essay will be published in the Official Government Report of the Exhibition in the German language, and also in the Committee's publications in an English translation.

COLLAPSE OF A MILL IN BELFAST.—A most serious accident occurred in Smithfield Spinning Mill, Belfast, on Monday morning. The accident came without any warning, and before the slightest effort could be made by the workpeople to escape from the building. Shortly before 10 o'clock the walls of three large rooms used for reeling purposes collapsed with a loud crash, bringing floors, machinery, and workers, many of whom were women, down with them to the basement. The mill was surrounded with a dense cloud of dust, which continued to rise for a considerable period from the ruins. As soon as the dust cleared somewhat it was evident that numbers of workpeople were struggling in the *débris*. Several men and women were quickly extricated, some unconscious, others apparently dead. The fire brigade was quickly on the scene, and very soon ten persons, some dead, were taken out; but an immense heap of brick, mortar, twisted machinery, and iron girders had yet to be tackled. The huge building is divided in two from top to bottom. Many who escaped being buried alive were seriously injured by the falling beams and machinery. The mill, which is the property of the Smithfield Flax Spinning and Weaving Co., has been working for over fifty years. Mr. Arthur Heardman, managing director, in an interview, attributed the accident to the collapse of one of the piers of the mill. The walls, he stated, have never shown any sign of weakness. The manager of the mill has expressed the opinion that the pillars supporting the first floor gave way, and that the entire upper portion of the building thus was brought down. Other theories to account for the collapse of the mill have been mentioned.

YORKSHIRE FEDERATION OF BUILDING TRADES EMPLOYERS.—The annual dinner of the Yorkshire Federation of Building Trades Employers was held on the 16th inst. at the Windmill Hotel, York. Councillor Mansfield, York, President, occupied the chair. The company numbered about 130. After dinner the usual loyal and patriotic toasts were honoured. Mr. John Dawson (Huddersfield) submitted the toast of "The National and County Federations." He remarked that if they were true to themselves, they would lift up the building trade to its proper dignity and level. They were not associated together for the purpose of aggression of their workpeople. On the other hand, they desired the latter to do that which was just, fair, and honest to their employers. There were some things in the building trade that would not bear the light of day. There were honest, good workmen, but they were overridden, and not allowed to have their way.—Mr. J. Lowry (Newcastle), in responding, said the Federation had advanced much during the last few years. It was doing good work throughout the country, and he had no doubt would continue to do so. Mr. G. White (Sunderland), in proposing "The Yorkshire Federation," acknowledged the support given by the society to the Tyneside employers during the protracted dispute of last year. The President replied, submitting that it was their duty to see that their clients got value for their money, and to educate the men to a higher ideal than that of doing the minimum amount of work for the maximum amount of pay. Ald. Jessop (Huddersfield) also responded. —At the business meeting in the afternoon, the President urged upon the members greater loyalty and devotion to the Yorkshire Federation and its work during the ensuing year. The annual report and balance-sheet were presented and adopted as a most satisfactory record of the past year's work. The question of uniform working hours for the operatives was held over until the various branch reports came in. It was resolved that all ex-presidents of the Yorkshire Federation be admitted members of the Executive Council, ex-officio. The treasurer, Mr. W. R. Thompson (Dewsbury), in retiring from his office after four years' arduous labours, received the thanks of the Federation; and Mr. W. E. England (Barnsley) was elected to the vacancy. Mr. Geo. Stanley, of Hull, was re-elected to the position of secretary.

OPEN SPACES AND PLAYGROUNDS.—Subscriptions have been made by the Corporation of London (600*l.*), the U.D. Council of Walthamstow (300*l.*), and Mr. E. North Buxton (300*l.*), towards the estimated cost (1,800*l.*) of adding about three acres of water area to the Hollow Pond. The Corporation laid out the ornamental pond, which is available for swimming and boating, four or five years ago in some swampy ground of the Leyton Flats, which form the southern portion of Epping Forest.—The London Playing Fields Society have acquired the Magdalen playing ground, at Earlsfield Station, on the London and South-Western line, in place of the Burntwood Field, which is now to be converted for building purposes. The society have taken a lease of about thirty acres, at Raynes Park, recently bought by Lord Alverstone, Lord Kinnaird, Sir E. Chandos-Leigh, and others, and to be transferred to the society as soon as the purchase-money, about 8,000*l*, is forthcoming. To that sum the Trustees of the London Parochial Charities Fund contribute 1,000*l.*—It is stated that Mr. W. H. Lever has offered to Bolton, his native town, an estate which extends over 360 acres, and comprises Rivington Park, and will lay out the park and grounds for purposes of recreation and resort, by dismantling the farms, removing the fences, and otherwise clearing the ground; and that Colonel G. A. Cooper, of Barrington Park, Burford, is about to present Grant Lodge and its grounds to Elgin, his birthplace. The house and grounds, of forty acres, lie near the cathedral.—The Metropolitan Public Gardens Association have agreed to lay out the churchyard of St. Paul's, Larkhall-rise, Clapham, and the garden of St. Philip's, Avondale-square, Old Kent-road, S.E., and invite contributions to a sum of 50*l.* for making a school playground in Bethnal Green. The Society have under consideration the excessive and unskilful lopping of trees in various quarters of London, and intend to oppose the projected construction of a second tubular railway beneath Hampstead Heath.

INCORPORATED CHURCH-BUILDING SOCIETY.—This Society held its usual monthly meeting on Thursday, the 16th inst., at the Society's House, 7, Dean's Yard, Westminster Abbey, S.W., the Rev. Canon C. F. Norman in the chair. Grants of money were made in aid of the following objects, viz.:—Building new churches at: Glass Houghton, St. Paul, near Castleford, Yorks, 40*l.*; Lansdowne, Holy Trinity, near Burton-on-Trent, Derby, 25*l.*; Scarborough, St. Saviour, Yorks, 40*l.*; South Retford, Notts, 80*l.*; Upton Park, St. Alban, Essex, 150*l.*; Middlesbrough, St. Columba, Yorks, 130*l.* in lieu of former grant of 112*l.*; Pockthorpe, Emmanuel, near Norwich, 100*l.* in lieu of former grant of 70*l.*; and Thornaby-on-Tees, St. Luke, Yorks, 70*l.* in lieu of former grant of 40*l.*; and towards enlarging or otherwise improving the accommodation in the churches at Gunness, near Doncaster, Lincs., 5*l.*; Hartshorne, St. Peter, near Burton-on-Trent, Derby, 20*l.*; Hull, St. Barnabas, 10*l.*; and Newland, St. Augustine (Hull), 20*l.* The Society likewise accepted the trust of a sum of money as a repair fund for the Church of St. Andrew, Horbling, Lincs. The following grants were also paid for works completed:—Sparkbrook, Emmanuel, near Birmingham, 500*l.* on account of a grant of 1,000*l.*; Hanley, St. Jude, near Stoke-on-Trent, 250*l.*; Chevening, St. Botolph, near Sevenoaks, Kent, 30*l.*; Llanfihangel-Glyn Myfyr, St. Michael, Denbigh, 10*l.*; Manningtree, St. Michael and All Angels, Essex, 25*l.*; Willesden, St. Matthew, Middlesex, 250*l.*; Plumstead, St. Paul, Kent, 150*l.*; West Malling, St. Mary, Kent, 50*l.*; Preston, St. Matthias, Brighton, 20*l.*; and West Bromwich, The Good Shepherd, Staffs, 25*l.* In addition to this the sum of 143*l.* was paid towards the repairs of fifteen churches from trust funds held by the Society.

INSTITUTE OF BRITISH DECORATORS.—Mr. G. C. Haité continued his course of lectures to the Northern District of the Institute of British Decorators, in the Museum Galleries of the Manchester School of Art, on Thursday, the 16th inst., his subject being "Decoration: Its Methods and Materials." The lecturer said he must assume his audience to be conversant with the lecture delivered by him at Sheffield on November 28 last, when he dealt with the subject of decoration from a historic point of view; and he must also assume that he was addressing an audience of decorators. The connexion between architecture and decoration was of the greatest importance, and decorators should carefully study their relationship. Unfortunately in many cases of domestic decoration, with which one had to deal, there was no architecture worthy of the name; and to that extent, the decorator had nothing to work upon. There was much that was repulsive to good taste in the misapplication of form and colour in pictorial and decorative art, in jewellery, and even in advertising posters. It really seemed as if in the latter direction an official censorship was necessary. It was anomalous that we should have a censorship of plays for instance, and no supervision of what passed as art in many of our public places. Bad decoration was, moreover, supposed to entail no consequences. The lecturer then spoke at considerable length on the principles of ornament. There were people who ridiculed the idea of law in decoration. Applied art, however, depended on law. The essential principles, underlying everything else, were fitness and beauty. Their application must be fit as to time, fit for the place, fit for the object decorated, and fit as to the medium employed. He enumerated some of the laws which were interpretations of the principles referred to: symmetry, balance, proportion, spacing, subordination, repose, radiation, contrast, repetition, rhythm, &c. Beauty might be defined as a harmonious co-operation of many pleasing qualities. Decoration was subject to many limitations, and often these limitations conferred positive advantages. Take, for instance, the Moorish prohibition of the imitation of nature. As a result of that, we had the use of many forms showing very beautiful results. The limitations imposed by lines in lead light work were an absolute necessity, yet once recognised, what possibilities arose in their use. In stencilled ornament the fact of having to use ties imposed certain limitations. When properly employed, ties became a very effective part of the ornament. Coming to essentially modern forms of decoration, there appeared to be two schools of thought in existence, one of which would prohibit many examples of manufactured goods, believing that the true sphere of the decorator was in the production of ornament in the flat, and the other recognising that the goods made ready to hand were a product of the time, meeting real needs, and their use, therefore, quite legitimate. The first idea implies that every executant should be a designer, and he was in favour of this, if the men could only be found. We must differentiate, however, between a designer and a house-painter, for design required a master hand. He would urge upon all decorators the desirability of having private designs, prepared for them by competent designers. Such men could offer great advantages to their clients. Speaking of the many relief materials now in use, the lecturer pointed out many decorative possibilities, if only the circumstances attending their use were fully considered. These materials were put into the decorator's hand in an incomplete state, and left for him to finish. By a wise selection and use of them, good effects might be produced.

PRESENTATION BY PENRHYN QUARRYMEN.—The following is a copy of a resolution passed at a meeting of the workmen and officials now employed at the Penrhyn Quarry:—"Resolved unanimously, that we, the workmen and officials now employed at the Penrhyn Quarry, beg to tender to the Hon. Ina Douglas Pennant our most respectful and sincere congratulations on the occasion of her approaching marriage, and to ask her kind acceptance of the accompanying tea kettle and candelabra, which we are proud to have the privilege of offering as an expression of our sincere regard and esteem for herself personally, and our attachment and respect for Lord and Lady Penrhyn and family, from whom we have always received, in health and in sickness, the greatest possible kindness and consideration. Signed on behalf of the workmen and officials:—H. P. Meares, R. Williams, W. McKie, J. Jack, E. Mills Roberts, David D. Davies, H. P. Roberts, R. J. Jones, William Thomas, John Evans, W. J. Griffith, John Thomas, Robert Jones, David Pritchard, Melancthon Williams, Percival Jones, William Roberts, John Williams, David Evans, William Edwards, W. W. Jones, William Roberts, John Ellis Jones, and Henry Pritchard."

THE EAST END DWELLINGS COMPANY.—From the report of this company, to be submitted to the nineteenth ordinary general meeting on February 3, we learn that terms have been arranged for a building lease of an important site in Bethnal Green, with frontages to Globe-road, Cyprus-street, and Gauber-street. As extensive building operations are now being carried on by the company on other sites in the immediate neighbourhood, it is not proposed at once to demolish the houses which are now on the land, but to wait for two or three years before beginning to rebuild. The new "Gretton Houses" on the Victoria Park-square Estate were opened in the autumn, and at the close of the year ninety-seven of the 168 tenements were let. Satisfactory progress is being made with the four blocks of dwellings on the site of the old Militia Barracks, and it is anticipated that they will all be ready for occupation in the summer. The new buildings on this site, which have been named "Thornhill Houses," are also progressing satisfactorily, and will be ready for occupation during the summer.

NORMAN ARCHES, CHATHAM.—A meeting was held at Chatham last week to consider what course should be adopted with reference to the Norman arches recently discovered in pulling down a portion of the parish church for the purpose of rebuilding the old Georgian nave. Letters were read from Dean Hole, Major-General Sir Charles Warren, and others, expressing a hope that steps would be taken to ensure the preservation of these interesting relics of the original Norman church. A resolution was moved in favour of enlarging the scope of the restoration scheme so as to include this proposal; and it was stated that it would entail an additional expenditure of 1,000*l.* Three Nonconformists of the borough strongly supported the preservation of "monuments of the past which connect Chatham with the days of William the Conqueror," and the motion was carried unanimously, it being arranged that a special fund should be raised for the purpose. It was stated that contracts had been signed for the final section of the restoration scheme at a cost of 6,000*l.*

WINDOW, ST. MICHAEL'S, MYLAND.—A two-light memorial window to a lady has been placed in this church. The subject is the Angel Gabriel standing over the kneeling figure of the deceased, who is received by the Saviour. The artist is Mr. E. J. Prest, of London.

CAPITAL AND LABOUR.

THE BRADFORD BUILDING TRADE SETTLEMENT.—On the 14th inst. Mr. A. Gadie, representing the Bradford Master Builders' Association, and Mr. T. Dalbridge, sen., representing the Operative Masons' Society, waited upon the Mayor of Bradford (Mr. W. C. Lupton) at the Town Hall, and formally gave their approval to the terms agreed upon on the previous day, under which a settlement was effected in the dispute between the masters and their employees. The suggestion that a Board of Conciliation should be formed was then taken into consideration, and it was agreed, on the suggestion of Mr. Gadie, assented to by Mr. Dalbridge, that Mr. Lupton should be invited to act as chairman of a Conciliation Board which should consist of five masters and five operatives, to be elected by the respective societies. Mr. Lupton, it was understood, was to continue to hold office apart from his occupancy of the Mayoral chair. Mr. Lupton agreed to serve in this capacity, and the proceedings closed with an expression of thanks to him for the efforts he had made to bring the dispute in the building trade to a conclusion.

BIRMINGHAM BUILDING TRADE.—The master builders of Birmingham, it will be remembered, recently notified the men in the various branches of the trade of their desire to so modify the working rules as to secure uniformity of working hours. At present the hour of commencing work varies with the occupations of the men, and the desire is to remove what must necessarily be a source of confusion and inconvenience. In consequence of trade depression they also notified certain reductions of wages—in the case of plasterers and masons 1d. per hour, fixers (who are engaged in fixing masonry) ¾d. per hour, and all the rest of the trades ½d. per hour. It was hardly likely that the men would agree to these proposals, and now that their replies have been received it is found that they have formally notified their opposition to any change, except in the case of the carpenters and plumbers, who, as a counter-blast, demand an advance of ½d. per hour. The committee of the Birmingham Master Builders' Association met on the 17th inst. to consider the position. There was a large attendance, and after a long discussion it was resolved to invite the representatives of the men to a conference on an early day.—*Birmingham Post.*

LEGAL.

ACTION AGAINST A BUILDING OWNER.

IMPORTANT POINT.

THE case of Hobbs *v.* Turner came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Romer and Mathew, on the 17th inst., on the appeal of the defendant from the judgment of Mr. Justice Kennedy in the King's Bench Division in favour of the plaintiff.

In this case the plaintiff, a metal worker, sought to recover from the defendant 27*l.* 10s. for work supplied for a house which was being erected for defendant by a builder under the supervision of an architect. The house was built under a contract in the form issued by the Royal Institute of British Architects, the contract price being 4,700*l.* The work was to be paid for by instalments as the work proceeded on the architect's certificate. Clause 28 of the contract provided that the provisional sums mentioned in the specification of materials to be supplied, or for work to be done by special artists or tradesmen, or for other works or fittings to the building, should be paid and expended at such times and in such amounts to such persons as the architect should direct, and the sums so expended should be payable by the contractor without discount or deduction, or by the employer to the said artists or tradesmen. It was further provided that the value of works which were to be executed by the contractor in respect of provisional sums, or in additional works, should be ascertained as provided by clause 13 of the contract. The contract further provided that at the settlement of the accounts the amount paid by the contractor to the artists or tradesmen, and the value of such works executed by the contractor, should be set against all such provisional sums or any sum provided for additional works, and the balance should be added to or deducted from the contract sum.

The specification contained this clause: "provide and fix iron balcony railings to design (allow 20*l.* for this, irrespective of carriage, fixing, and profit)." The architect (Mr. J. L. Williams) decided that the plaintiff, Mr. Hobbs, was to supply the ironwork for the balconies, and the builder asked Mr. Hobbs to send the designs to Mr. Williams, which he did. Mr. Williams, however, rejected the designs and sent the plaintiff his own designs. The ironwork was sent by the plaintiff to the builder, who had given the measurements and quantities, and the goods were invoiced and debited to the builder. Subsequently, on the invitation of the builder, Mr. Hobbs sent him his account. Later on, the builder wrote to Mr. Hobbs stating that Mr. Williams would certify the amount direct to the building owner (the defendant), which Mr. Williams did, giving a certificate in favour of the plaintiff for 27*l.* 10s. The plaintiff sent this certificate to the defendant, who kept it, but made no reply to the applications by the plaintiff for the money. As soon as the matter was placed in the plaintiff's solicitor's hands, the defendant denied liability, alleging that he had a claim against the builder for bad work. Mr. Justice Kennedy held that it would be wrong to the plaintiff to make him get payment of his money from the bnilder who had not had the money, and who, but for the certificate against the defendant, would have had a certificate including the amount in question, months before. He was of opinion that the suggested claim by the defendant against the builder, which was at most a claim for damages which might or might not succeed, did not affect the matter, and gave judgment for the plaintiff for the amount claimed, with costs. Hence the present appeal of the defendant.

At the conclusion of the arguments of Counsel, the Master of the Rolls, in giving judgment, said that, in his opinion, when one looked at the whole of the contract taken together, and not relying upon any one particular clause, the proper inference to be drawn as regarded this particular class of work was that it was intended that the building owner, and not the builder, should be the principal. If the builder entered into a contract for any of this class of work, he might make himself liable to the tradesman or artist; but as he was acting under the general scope of the contract, he would be acting as the agent of the building owner, and would create privity of contract between the building owner and the tradesman or artist. That could only be got rid of by the tradesman or artist contracting with the builder in such a way as to debar himself from resorting to the building owner. Nothing of that kind occurred in the present case. The plaintiff was put into relation with the defendant through the architect, and the order was given to the plaintiff by the architect. Although the invoice was sent to the builder by the plaintiff, the architect gave a certificate against the defendant and not against the builder, and sent it to the defendant. He thought, looking at the contract as a whole, the initial liability of the defendant in respect of this class of work was established, and that all the parties dealt upon that footing. He thought that the appeal should be dismissed.

The Lords Justices concurred.

Mr. Clavell Salter appeared as counsel for the appellant, and Mr. Arthur Powell for the respondent.

CLAIM BY THE EXECUTORS OF A QUANTITY SURVEYOR AGAINST AN ARCHITECT.

THE case of Leach *v.* Arber came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Romer and Mathew, on the 18th inst., on the appeal of the plaintiff from the decision of Mr. Justice Bigham, sitting without a jury, in the King's Bench Division on January 14 and 15, 1901. The case was fully reported in the *Builder* of January 19, 1901.

The action was brought by the executors of a gentleman named Robertson, a quantity surveyor who had died, to recover from the defendant, an architect, a reasonable sum for the preparation of some specifications required for the construction of a theatre and hotel at Plymouth. The question for determination was whether there was an implied promise on the part of the defendant to pay for the work, it being admitted by the plaintiffs that there was no express promise on his part. It seemed that in 1897 a Mr. Earl was employed by Mr. Robertson to assist him in the preparation of the bills of quantities for the theatre and hotel in question, and he was employed by Mr. Robertson on the terms that the remuneration that Mr. Robertson was to receive for the work should be divided equally between them. Mr. Earl did assist Mr. Robertson in the preparation of the bills of quantities, and received from Mr. Robertson in his lifetime the remuneration he was entitled to. When the bills of quantities were about to be prepared Robertson appeared to have discovered that Earl had in his possession the plans and specifications relating to a theatre at Edinburgh which, he thought, might be of assistance to the defendant who was the architect for the buildings in question. Earl's version of an interview which he had with Mr. Arber was that the latter told him that it would be a great assistance to him in the preparation of the plans if he could be furnished with specifications, and asked Earl to prepare them, and that he (Earl) would make the necessary arrangements with Robertson for payment and the work to be done. The plaintiff's case was that Earl then proceeded to draw out the specifications for the buildings. Mr. Arber, on the other hand, denied that he ever said anything or did anything to convey to Earl the idea that he was intending to pay for the specifications at all, or that he requested Earl to prepare them for him. Mr. Justice Bigham accepted Mr. Arber's version of what took place, and said that in his opinion the specifications were drawn out by Earl for the benefit of Robertson in preparing the bills of quantities, which were used by Mr. Arber in his capacity as architect. His lordship was of opinion that Mr. Arber was not liable to pay for the preparation of the specifications, but if the Court of Appeal should decide that he was wrong in holding that Mr. Robertson's executors were not entitled to recover in the action he found as a fact that 40*l.* would be ample payment for the work which was almost entirely desk work and consisted of little more than copies of the specifications which Earl had in his possession relating to the Edinburgh theatre. His Lordship accordingly entered judgment for the defendant with costs. Hence the present appeal of the plaintiff.

At the conclusion of the appellants' case their Lordships affirmed the decision of Mr. Justice Bigham and dismissed the appeal with costs.

Mr. Nepean was counsel for the appellant, and Mr. Schillar for the respondent.

RECENT PATENTS:

ABSTRACTS OF PATENTED INVENTIONS.

16,981.—A TUNNELLING-SHIELD: *C. G. Hastings.*—A curved cutting-edge is formed by bringing the inner and outer cylinders together in front, a slotted hood being placed at the rear; the hydraulic advancing cylinders, which are held with pivoted yokes to allow of their being turned aside, are laid between trusses which strengthen the partitions of the space between the cylinders, and there are partitions and floors with front cutting-edges that divide the middle part into cells into which deflecting-plates direct the spoil; hinged doors fitted with hinged louvres are arranged in removable bulkheads in front of each of the cells.

17,005.—STOPPING-PIECES FOR EARTHENWARE PIPES AND JUNCTIONS: *R. Ewing.*—The stopper is either joined on to the pipe-socket before the pipe is dried or fired, or cemented to it when the pipe has been fired; the stopper can be chipped away along a groove, as the internal diameter of the flange exceeds the external diameter of the pipe-spigot; the invention will serve for a socket, having an annular shoulder as is specified in Nos. 9,360 of 1891, and 30,241 of 1897.

17,008.—APPLIANCES FOR WINDOW SASHES: *W. K. Lee.*—At the lower ends of sliding stiles, secured to the cords, are pivots or studs about which the sashes can be turned. Pivoted catches will hold the sliding stiles as the sashes are being taken out of the frames, and thumb-screws in screwed plates fasten the stiles to the sashes.

17,029.—A CONTRIVANCE FOR USE WITH WINDOWS: *R. Vachell.*—The inventor's object is to obviate the risk of trapping one's hand between the sill and the falling sash. He attaches stops to the frame beneath the upper sash, which will thereby be sustained in the event of the cords being broken.

17,036.—SCALES FOR DRAUGHTSMEN'S USE: *J. Lukowsky.*—Two detachable scales, available for use in enlarging or reducing plans, maps, and so on, are joined together with two end pieces in such a manner that whilst a narrow slit remains between them their zeros shall coincide at a hole, in one end-piece, in alignment with the slit. Transparent material is laid over the drawing or plan, which can then be enlarged or reduced by plotting points from a needle fixed through the hole in either of the two end-pieces.

17,043.—A COMBINED LIQUID AND SPRING DOOR-CHECK: *W. H. Taylor.*—A piston in a closed cylinder that contains the liquid is joined with a connecting-rod to a crank upon a shaft which is joined indirectly to the inner end of a spiral spring, of which the outer end is secured to the casing; a lever from the squared end of the shaft is attached to the door-frame; the piston impels the liquid through a by-pass (a screw-down valve regulating the rate) as the spring closes the door, and the door can be caused to shut either slowly or quickly by an adjustment of the angular relation between the piston and the shaft-lever. The mechanism may avail for right or left hand closing by joining the inner end of the spring to a sleeve which one can lift out with the spring and invert, a feather on the sleeve joining it to another sleeve to which a pawl gearing with teeth upon the flange connects the lever.

17,056.—A MACHINE FOR WORKING WOOD, STONE, METAL, &C.: *F. Midböe.*—The machine is devised for turning, cutting, or boring in connexion with a copying-lathe; a pivoted lever upon a slide is worked by a templet, which is driven from the mandrel by the moving of a pin lengthwise in its guides, an adjustable spring forces a rod against the lever of which the upper end presses against the rod which is secured to the tool-slide; the other slide that carries the pivots of the lever can be moved vertically so as to vary the motion imparted to the tool and thereby change the dimensions of the work.

17,058.—APPLIANCE FOR CHIMNEYS AND STOVE-PIPES: *W. A. Gay and R. D. Argue.*—An inner pipe having hooded openings is carried upon tabs which engage with eyes upon the stove-pipe or lie upon the top of the chimney; the pipe may consist of two separated halves, and a damper be inserted between the two parts or in a contracted outlet formed in the lower half.

17,061.—MEANS OF JOINING WOODEN POSTS TO STONE, CONCRETE, OR METAL: *F. W. Commons.*—In the case of a post fastened with a tubular metallic key to a foundation of stone the end of the post is recessed for taking a damp-proof layer of cement or asphalt and a corrugated hoop-iron band is driven into it, a dowel or wedge serving to expand the wood in the tube; the posts may be built up in sections to be joined together by tubes, dowels, and cross-bolts that are passed through plates of metal.

17,086.—MECHANISM FOR USE IN WORKING CRANES: *W. Deutsch.*—To make the crane turn automatically as the load nearly reaches the height required, a sleeve having screw threads carries the lower pivot of the jib, and on to a bracket of the jib is pivoted the short end of a lever that engages between the threads and has an eye in its longer end through which the jib-rope is passed. As the eye is engaged by the load, or by a projection from the rope, the turning of the lever upon its pivot makes the crane turn around its pivot. In another form the rope is passed from the jib directly to the drum and the screw threads are made on the crane-post.

17,103.—AN APPLIANCE FOR CLEANSING DRAINS: *W. H. Gibbs.*—Obstructions are removed with an appliance that consists of a series of sector-shaped blades, whereof the first is fashioned with a spiral edge, which are threaded spiral-wise upon a flat stem which is fitted with spacing collars.

17,124.—A PROTRACTOR OR GAUGE FOR GAUGING, MARKING-OFF, AND TESTING PURPOSES: *A. F. Lucy and L. H. Turtle.*—The instrument, which is intended to serve also for setting or adjusting tools, marking off and setting out centres, the teeth of wheels, and testing and gauging bevels, comprises a sector, a fixed rule, and a stock. Angular graduations upon the sector mark the position of the rule in respect of the base and one face of the stock, the sector being placed between a rounded seat in the stock and a circular boss, and a stop limiting its movement in one direction. The graduated edge of the rule is passed through the centre of motion of the sector between a slot in the latter and a slot in the screw which clamps the sector in its place. At one end of the rule is a right-angled lug for use in callipering, at its other end is a bevel, and when the rule is at a right angle with the base it will bisect the angle—which should be a right angle—between the equal faces of the stock, the index-line being at the lower end of a scale on the stock.

17,139.—CONVERTIBLE COMPASSES, CALLIPERS, AND DIVIDERS: *H. Terlin.*—The chief novelty consists of providing a fine adjustment by means of a ratchet-toothed sector upon the one leg, that is inserted through a slot in the other leg, with a screw or worm upon a pivoted piece which a spring keeps in or out of engagement with the sector. For describing circles about a cylindrical hole, the radius is set out with a scale having a V-shaped slot and a ball-shaped end, which can be attached to the leg, is put into the hole, and the scale is then caused to slide along until the sides of the V become tangents of the spherical ball. Other adaptations of the instruments are specified, such as dotting-wheels, cutting-blades, and points with cup-shaped ends, that can be attached to the legs in place of points.

17,168.—DOOR LATCHES AND HANDLES: *S. W. Mace.*—The various parts of the latch are stamped out of sheet metal, and the handle is stamped from a blank; a recess in the bottom die corresponds with the shape of the bow, and there is a raised part which will fashion the middle of the handle and corresponds with a recess in the top die. Before the blank is put between the dies it is partly curved upwards, and is then kept in its place with studs projecting from the lower die.

17,211.—CONDUITS FOR ELECTRICAL CONDUCTORS: *L. Marsh.*—The conduits or casings are made of single or multiple troughs into which insulating linings are inserted; a flanged cover, similarly lined and having joints that will overlap, is screwed down on to the supports.

17,233.—BLOCKS OR BRACKETS FOR USE WITH SCAFFOLDING: *R. Brierley.*—Planks upon roofs or other sloping surfaces are carried by wedge-shaped blocks of wood, on the faces of which are metallic plates having inclined spikes that will enter into the woodwork or rafters.

17,285.—WINDOW SASHES AND THEIR FITTINGS: *F. Sewell.*—In order that the sashes may be turned inwards upon occasion, and that the lower sash may be turned outwards for affording ventilation, the inventor hinges the lower halves of the pulley stiles on to the frame. When one wishes to turn the sashes downwards, the guide pulleys of the cords are taken out of recesses in the pulley stiles, and are then forced backwards clear from the sashes. When the sashes slide in the frame, pins that project from the sash stiles and slide in vertical guiding-grooves cut in the lower halves of the pulley stiles retain the sash cords of the lower sash, and a rebate in the fixed portion of the pulley stiles takes the cord. In a variant adaptation the cords are secured to hooks upon the upper ends of the lower sash stiles, the upper sash being kept in its position—when both are turned down—by the engagement of a stop-pin with a groove in the stile of the upper sash. Hinged stays sustain the stiles in a horizontal position, and the latter may be fastened with bolts or other means when they are vertical or are partly opened within the frame.

17,289.—ELECTRICAL SWITCHES: *A. H. Adams.*—In cases where the main switch and rheostat interlock (*see* No. 23,371 of 1899) a loose handle works the main switch arms that engage with the contacts fitted with springs that tend to force the contacts outwards. An arm, having at its one end the armature of the minimum magnet and at its other end a spring, controls the detents which hold the contacts. The arm of the rheostat, held by resistances cut out by a magnet, and the main switch are interlocked by means of an arm, and an overload magnet will short-circuit the electro-magnet in the event of an excess of current.

17,315.—SPRINGS OF LOCKS FOR LATCHES AND SIMILAR PURPOSES: *S. R. Parkes and W. H. Appleby.*—The inventors contrive that the bent portion of each steel spring shall bear against a corner-piece, whilst one end of the spring presses against a projection from the bolt and the other end against a stopping-piece. The corner-piece constitutes one end of the lock-casing, of which the other end and the sides are fashioned in one piece; they also make an additional bend in the spring, for another form of the contrivance, the bend being adapted for engagement with a rounded, half-rounded, or otherwise shaped block, which takes the place of the corner-piece.

17,321.—A FLEXIBLE CONNEXION FOR USE WITH DREDGING APPARATUS: *L. W. Bates.*—The object of the invention is to provide means of connecting the end of a floating discharge-pipe to the dredger; upon the pontoon which supports the end-length of the floating discharge-pipe are guides fitted with brackets, of which the pins will serve as a pivot for another bracket, the latter bracket being linked or jointed to a strut which is secured to the dredger above the dredger discharge-pipe; a ferrule on the bent portion of the pipe is joined to a ferrule at the end of the floating discharge-pipe. Wedge-shaped cylinders can be placed between the parts of the pipe and the sleeve when the two portions of the pipe are employed at a considerable angle the one to the other.

MEETINGS.

FRIDAY, JANUARY 24.

Architectural Association Discussion Section.—Mr. F. G. W. Buss on "The Clerk of Works: His Duties and Responsibilities." 7.30 p.m.

Birmingham Architectural Association.—Mr. Halsey Ricardo on "The Gothic Revival."

Devon and Exeter Architectural Society (Plymouth, Devonport, and Stonehouse Branch)—Annual Dinner.

Glasgow Architectural Craftsmen's Society.—Mr. James Lochhead on "Hospital Planning and Construction." 8 p.m.

SATURDAY, JANUARY 25.

Institution of Junior Engineers.—Seventeenth Anniversary Dinner, at the Hotel Cecil, the President (Sir John Jackson, F.R.S.E.) in the chair. 6.30 p.m.

The Builders' Foremen's Association (Memorial Hall, Farringdon-street, E.C.).—Mr. F. Morgan on "The Solar System."

Dundee Institute of Architecture.—Visit to Perth.

MONDAY, JANUARY 27.

Surveyors' Institution.—Discussion on the paper recently read by Mr. A. Dudley Clarke, and on a paper to be read by Mr. G. S. Mathews, both entitled "The Final Report of the Local Taxation Commission." 8 p.m.

Society of Arts (Cantor Lectures).—Dr. Samuel Rideal on "The Purification and Sterilisation of Water." III. 8 p.m.

Timber Trades Benevolent Society.—Annual Meeting, Cannon-street Hotel, and the election of three pensioners. 11.30 a.m.

TUESDAY, JANUARY 28.

Institution of Civil Engineers.—(1) Mr. G. Davis on "The Sewerage Systems of Sydney, N.S.W., and its Suburbs"; (2) Mr. W. Naylor on "The Bacterial Treatment of Trade Waste." 8 p.m.

WEDNESDAY, JANUARY 29.

Society of Arts.—Mr. Clayton Beadle on "Technical Education as Applied to Paper-making." 8 p.m.

Northern Architectural Association.—Mr. R. P. S. Twizell on "The Development of Architectural Ornament." 7.30 p.m.

THURSDAY, JANUARY 30.

Royal Institution.—Dr. A. S. Murray on "Recent Excavations at Delphi and in the Greek Islands." III. 3 p.m.

Leeds and Yorkshire Architectural Society.—Mr. W. H. Thorp on "An Old Court Quarter of Paris." 6.30 p.m.

FRIDAY, JANUARY 31.

Architectural Association.—Mr. C. Harrison Townsend on "Originality in Architectural Design." 7.30 p.m.

Institution of Civil Engineers (Students' Meeting).—Messrs. J. C. Collett and W. H. C. Clay on "The Quay-Walls of Keysham Harbour." 8 p.m.

SATURDAY, FEBRUARY 1.

Architectural Association.—First Spring Visit, to Christ Church, Brixton-road, by permission of Professor Beresford Pite, the architect of the building.

Sanitary Inspectors' Association.—Nineteenth Annual Dinner. 6.30 p.m.

Edinburgh Architectural Association.—Visits. (1) to Archers' Hall; (2) to Craigmiller Park United Free Church.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

January 15.—By BRADSHAW, BROWN, & CO.

Stepney.—1, 2, and 3, Ann-st., u.t. 40¼ yrs., g.r. 7*l.* 10s. £585

Millwall.—5 and 7, Strafford-st., u.t. 20½ yrs., g.r. 4*l.* 200

383, West Ferry-rd., u.t. 22 yrs., g.r. 2*l.* 10s. .. 120

By MONTAGUE HIBBARD & CO.

Stoke Newington.—10, Dynevor-rd., u.t. 73 yrs. g.r. 6*l.*, r. 34*l.* 370

By FOSTER & CRANFIELD.

Ilford, Essex.—Cranbrook-rd., part of the "Cranbrook Park Building Estate," 25a. 1r. 36p., f. 25,350

Contractions used in these lists.—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; yd. for yard.

PRICES CURRENT OF MATERIALS.

*** Our aim in this list is to give, as far as possible, the *average* prices of materials, not necessarily the lowest. Quality and quantity obviously affect prices—a fact which should be remembered by those who make use of this information.

BRICKS &c.

	£	s.	d.		
Hard Stocks	1	11	6	per 1,000 alongside, in river.	
Rough Stocks and Grizzles	1	9	6	,,	,, ,,
Facing Stocks	2	12	0	,,	,, ,,
Shippers	2	5	0	,,	,, ,,
Flettons	1	8	0	,,	at railway depôt.
Red Wire Cuts ..	1	12	0	,,	,, ,,
Best Fareham Red	3	11	0	,,	,, ,,
Best Red Pressed Ruabon Facing.	5	5	0	,,	,, ,,
Best Blue Pressed Staffordshire ..	4	6	6	per 1,000 at	railway depot.
Do., Bullnose	4	10	0	,,	,, ,,
Best Stourbridge Fire Bricks	4	5	6	,,	,, ,,
GLAZED BRICKS					
Best White and Ivory Glazed Stretchers.....	13	0	0	,,	,, ,,
Headers	12	0	0	,,	,, ,,
Quoins, Bullnose, and Flats	17	0	0	,,	,, ,,
Double Stretchers	19	0	0	,,	,, ,,
Double Headers..	16	0	0	,,	,, ,,
One Side and two Ends	19	0	0	,,	,, ,,
Two Sides and one End	20	0	0	,,	,, ,,
Splays, Chamfered, Squints	20	0	0	,,	,, ,,
Best Dipped Salt Glazed Stretchers and Headers ..	12	0	0	,,	,, ,,
Quoins, Bullnose, and Flats	14	0	0	,,	,, ,,
Double Stretchers	15	0	0	,,	,, ,,
Double Headers..	14	0	0	,,	,, ,,
One Side and two Ends	15	0	0	,,	,, ,,
Two Sides and one End	15	0	0	,,	,, ,,
Splays, Chamfered, Squints.....	14	0	0	,,	,, ,,
Seconds Quality White and Dipped Salt Glazed	2	0	0	,,	less than best.

	s.	d.	
Thames and Pit Sand	7	3	per yard, delivered.
Thames Ballast	6	0	,, ,,
Best Portland Cement	32	0	per ton, delivered.
Best Ground Blue Lias Lime..	25	0	,, ,,

NOTE.—The cement or lime is exclusive of the ordinary charge for sacks.

Grey Stone Lime..... 11s. 0d. per yard, delivered.

Stourbridge Fire-clay in sacks, 26s. 6d. per ton at rly. dpt.

STONE.

	s.	d.	
Ancaster in blocks	1	11	per ft. cube, deld. rly. depôt.
Bath ,, ...	1	7	,, ,,
Farleigh Down Bath ..	1	8	,, ,,
Beer in blocks	1	6½	,, ,,
Grinshill ,, ...	1	10	,, ,,
Brown Portland in blocks	2	2	,, ,,
Darley Dale in blocks..	2	4	,, ,,
Red Corsehill ,,	2	5	,, ,,
Red Mansfield ,,	2	4	,, ,,
Hard York in blocks ..	2	10	,, ,,
Hard York 6 in. sawn both sides landings, to sizes (under 40 ft. sup.)	2	8	per ft. super. at rly. depôt.
,, ,, 6 in. Rubbed Ditto..	3	0	,, ,,
,, ,, 5 in. sawn both sides slabs (random sizes)	1	3	,, ,,
,, ,, 2 in. self-faced Ditto	0	9½	,, ,,
Hopton Wood (Hard Bed) in blocks	2	3	per ft. cube. deld. rly. depôt.
,, ,, ,, 6 in. sawn both sides landings	2	7	per ft. super. deld. rly. depôt.
,, ,, 3 in, do.	1	2½	,, ,,

[*See also page 99.*

COMPETITIONS, CONTRACTS, AND PUBLIC APPOINTMENTS.

(For some Contracts, &c., still open, but not included in this List, see previous issues.)

COMPETITIONS.

Nature of Work.	By whom Required.	Premiums.	Designs to be delivered
*Laying-out Pleasure Ground	Aldershot U.D.C.	20*l.*, 10*l.* and 5*l.*	Mar. 1
*Public Offices, Mortuary, Fire Station, &c.	Maldens & Coombe U.D.C.	25*l.* and 10*l.*	Mar. 5
*Proposed Public Offices	Aldershot U.D.C.	100*l.*, 75*l.* and 50*l.*	Mar. 29
*New Town Hall	Harrogate Corporation	150*l.*, 100*l.*, and 75*l.*	May 14

CONTRACTS.

Nature of Work or Materials.	By whom Advertised.	Forms of Tender, &c., Supplied by	Tenders to be delivered
*Making-up Bevington and Warwick-roads	Beckenham U.D.C.	J. A. Angell	Jan. 27
*Road Making and Paving Works	Willesden District Council	Council's Engineer, Dyne-road, Kilburn, N.W.	Jan. 28
Road Works, Dryden, and other roads	Croydon Town Council	E. Mawdesley, Town Hall, Croydon	do.
Drainage Works, Woodbridge	Guildford & Woking Hospital Brd	E. L. Lunn, Surveyor, 36, High-street, Guildford	do.
*Erection of Buildings at Gasworks	Ashford U.D.C.	Stevenson & Burstal, 38, Parliament-street, Westminster, S.W.	do.
Twenty-two Cottages, Pantyffynon	Tycroes Building Club	D. J. Michael, 9, Wind-street, Swansea	do.
Shop Premises, Great Yarmouth	Mr. Hannant	A. S. Hewitt, Architect, Bank Chambers, Great Yarmouth	do.
Additions to Gasworks	Ashford (Kent) U.D.C.	Stevenson & Burstall, Engineers, Parliament-street, S.W.	do.
Two Houses and Stables, Beeston, Yorks	Mr. W. L. Ingle	Buttery & Birds, Architects, Queen-street, Morley	do.
Technical Institute, Beam-street	Nantwich U.D.C.	C. E. Davenport, Architect, Nantwich	do.
Alterations, &c., to Woodlands Farm	Guildford R.D.C.	E. L. Lunn, Architect, 36, High-street, Guildford	do.
*Supply of Flints and Cockle-shells	London County Council	Parks Department, 11, Regent-street, S.W.	Jan. 29
Shops, &c., Hessle-road, Hull	North Eastern Railway Company	W. Bell, York	do.
Additions to Schools, Cornwall	St. Agnes School Board	Carder & Carder, 4, Princes-street, Truro	do.
Synagogue and Schools, Hull		B. S. Jacobs, Architect, Bowlalley-lane, Hull	do.
House, &c., High-street, Haverhill, Suffolk	Messrs. Greene & Company	A. A. Hunt, Architect, Sudbury	do.
Street Works, Chadwell	Orsett (Essex) R.D.C.	F. Lowry, Civil Engineer, Hornchurch, Essex	do.
Station Buildings, Pegswood, Northumberland	North-Eastern Railway Company.	W. Bell, Central Station, Newcastle-on-Tyne	do.
Artesian Well, Haughley	East Stow R.D.C.	R. E. Wilkes, Stowmarket	do.
Creamery	Croom, &c., Co.-op. Dairy Soc., Ld	J. Hickey, Croom, County Limerick	do.
Alterations to Business Premises, Londonderry		J. P. M'Grath, Civil Engineer, 28 Carlisle-road, Londonderry	do.
Road Improvement Works, Maitland-road	Reading Corporation	J. Bowen, Borough Surveyor, Town Hall, Reading	Jan. 30
Sewage Works	Meltham (Yorks) U.D.C.	J. B. Abbey & Son, Civil Engineer, 34A, New-street, Huddersfield	do.
Additions to Infirmary, Bradford		Milnes & Frances, Architects, Bradford	do.
Porter's Lodge, &c.	Kingston-on-Thames Guardians	J. Edgell, Union Offices, Kingston	do.
Bridge, Purleigh	Essex County Council	P. J. Sheldon, Civil Engineer, Duke-street, Chelmsford	Jan. 31
Fire Station, The Crescent, Salford		H. Kirkley, Architect, 134, Deansgate, Manchester	do.
Buildings	Lytham (Lancs) U.D.C.	A. J. Price, Engineer, Council Offices, Lytham	do.
Granite Road Metal (16,000 tons), Aylesbury	Bucks County Council	R. J. Thomas, County Surveyor, Aylesbury	do.
Two Houses, Thuristone		G. Moxon, Architect, 26, Church-street, Barnsley	do.
Heating Infirmary	Celbridge Guardians	J. Whelan, Architect, Celbridge	do.
*Alterations and Sanitary Works at Infirmary	St. George-in-the-East Guardians	G. A. Wilson, Architect, Hopetoun House, Lloyd's-avenue, E.C.	do.
Hospital, Oak Bank	Glasgow Parish Council	A. Cullen, Architect, 45, Hope-street, Glasgow	Feb. 1
Broken Granite (1,000 tons)	Sleaford (Lincs) U.D.C.	E. Clements, Council Offices, Sleaford	do.
Additions to Workhouse, Low Leighton, New Mills	Hayfield Guardians	Garlick & Flint, Architects, 5, Terrace-road, Buxton	do.
Water-supply Works	Gwyrfai (Wales)	E. Evans, Civil Engineer, 8, Castle-street, Carnarvon	do.
Granite Road Metal	Norfolk County Council	T. H. B. Heslop, Civil Engineer, Norwich	do.
Drainage Works, Silkstone, Yorks	Penistone R.D.C.	Marriott & Co., Civil Engineers, Dewsbury	do.
Bacteria Beds, Crossgates, Dunfermline	Fife County Council	D. Mackenzie, Civil Engineer, County Buildings, Dunfermline	Feb. 3
Waterworks, Falkirk	Stirling County Council	Warren & Stuart, Civil Engineers, 94, Hope-street, Glasgow	do.
One hundred Houses, Penydarren	Merthyr Tydfil U.D.C.	T. A. Rees, Town Hall, Merthyr	do.
Farmhouse, Shenfield, Essex		L. H. Marshall, Surveyor, Chippenham	do.
Two Cottages	Darlington Corporation	Borough Surveyor, Town Hall, Darlington	do.
*New Sewers and Roads, Walmer	Walmer Estates, Co., Ltd.	Hinds & Son, Estate Agents, Walmer	do.
*Annual Contracts	Hendon U.D.C.	Council's Engineer, Public Offices, Hendon	do.
N. T. Rails and Gates	Market Harborough U.D.C.	H. G. Coales, Civil Engineer, Market Harborough	Feb. 4
*Hardwood Paving	Hackney Borough Council	Borough Engineer, Town Hall, Hackney	do.
*Making-up Southfield-road	Acton District Council	D. J. Ebbetts, 242, High-street, Acton, W.	do.
Wall, &c., at Sanatorium	Southend Corporation	A. Fidler, Civil Engineer, Southend	do.
*New Picture Gallery	Norwich Corporation	A. E. Collins, Guildhall, Norwich	Feb. 5
*Power Station and Car Sheds	Newport (Mon.) Council	Borough Engineer, Town Hall, Newport, Mon.	do.
Kerbing, &c., St. Alban's-road	Dartford U.D.C.	W. Harston, Surveyor, 8, Hythe-street, Dartford	do.
Granite Road Metal	Kettering U.D.C.	C. W. Lane, Kettering	do.
House, Crumlin, Mon.		R. L. Roberts, Architect, Abercarn	Feb. 7
Police Station, Harrogate-road	Leeds Corporation	W. H. Thorp, Architect, 61, Albion-street, Leeds	Feb. 8
Free Library, Chapeltown	do.	do.	do.
*Re-Erecting the Crown Bridge near Griffithstown	Panteg U.D.C.	D. J. Lougher, Engineer, Pontypool	Feb. 10
*Sewage Disposal Works	Lathom & Burscough U.D.C.	John T. Wood, Engineer, 3, Cook-street, Liverpool	do.
*Car Sheds and Offices, &c., Bilston	Wolverhampton Tramways, Ltd.	The Secretary, Donington House, Norfolk-street, W.C.	do.
*Tenders for Supplies, &c.	West Ham Council	Borough Engineer, Town Hall, Stratford, E.	Feb. 11
*Tenement Houses, Stratford	do.	Borough Engineer, Town Hall, West Ham, E.	do.
*Isolation Hospital	Southall Norwood U.D.C.	Council Offices, Southall, Middlesex	do.
*Extension of Goods Shed, &c., Plymouth	Great Western Railway Company	Engineer, North-road Station, Plymouth	do.
*Annual Contracts	Lambeth Borough Council	Borough Engineer, Town Hall, Kennington Green, S.E.	Feb. 13
Engine House, Cottage, &c., Albert-road	Stamford Corporation	J. B. Everard, Civil Engineer, 6, Millstone-lane, Leicester	Feb. 17
*Main Drainage Works, New Sewers, &c., &c.	Stamford Corporation	Engineer's Office, 6, Millstone-lane, Leicester	do.
*New Docks and Works, Avonmouth	Bristol Docks Committee	Engineer's Office, Underfall Yard, Bristol	do.
*Block of Artizans' Dwellings	Stepney Council	Borough Engineer, 15, Great Alie-street, Whitechapel, E.	Feb. 18
*18-in. Stoneware Pipe, Outfall Sewer, &c.	Hornsey U.D.C.	E. J. Lovegrove, Southwood-lane, Highgate, N.	Feb. 24
*Alterations to Bracebridge Asylum	The Visiting Committee	Giles, Gough & Trollope, 28, Craven-street, Strand, W.C.	Mar. 3
*New Buildings and Alterations and Additions	Kingston Union	Not stated	No date
Boiler House, &c., Droylsden, Lancs.	Messrs. Robertshaw & Sons	George & Sons, Architects, Ashton-under-Lyne	do.
Alterations to Orton Hall Farm, Great Orton		Carrick, Lee & Sons, Carlisle	do.
Cottage, Porthcawl		S. H. Stockwood, Bridgend	do.
House, Longmore, near Elgin		E. B. Pratt, Architect, County Bank House, Elgin	do.
Rebuilding the King's Arms Hotel, Litcham, Norfolk		L. F. Eagleton, Architect, Bank Chambers, King's Lynn	do.
Shops, South Hetton, Durham		R. Hogg, Murton Colliery, Durham	do.
Four Cottages, Shields-road, Pelaw		J. R. L. Harris, Architect, 1, Balloon-street, Manchester	do.
Boundary Walls, Burnley-road, Halifax	Messrs. Hogge & Seppings	W. H. D. Horsfall, Architect, Tower Chambers, Halifax	do.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Application to be in
*Master of Buildings	Liverpool School Board	250*l.*	Jan. 30
*Road Surveyor	*Hackney Borough Council	182*l.*	Feb. 4
*Clerk of Works	*Bradford Corporation	120*l.*	Feb. 5
*Architectural Assistant	Sheffield Corporation	150*l.*	do.
*Building Inspector	West Ham Council	150*l.*	Feb. 12

Those marked with an asterisk (*) are advertised in this Number. Competitions, p. iv. Contracts, pp. iv, vi, viii. x, xii, & xxii. Public Appointments, xviii, & xxii.

PRICES CURRENT (*Continued*).

SLATES.

in.	in.	£ s. d.	
20×10	best blue Bangor	11 15 0	per 1000 of 1200 at ry. dep.
,,	best seconds ,,	11 5 0	,, ,,
16×8	best ,,	6 12 0	,, ,,
20×10	best blue Portmadoc	11 5 0	,, ,,
16×8	best blue Portmadoc	6 0 0	,, ,,
20×10	best Eureka unfading green	19 2 6	,, ,,
16×8	,, ,,	7 5 0	,, ,,
20×10	permanent green	10 5 0	,, ,,
16×8	,, ,,	5 17 6	,, ,,

TILES.

	s. d.	
Best plain red roofing tiles	41 6	per 1,000, at rly. depôt.
Hip and valley tiles	3 7	per doz. ,, ,,
Best Broseley tiles	45 6	per 1,000 ,, ,,
Hip and valley tiles	4 0	per doz. ,, ,,
Best Ruabon Red, brown or brindled Do. (Edwards)	57 6	per 1,000 ,, ,,
Do. ornamental Do.	60 0	,, ,, ,,
Hip tiles	4 0	per doz. ,, ,,
Valley tiles	3 9	,, ,, ,,
Best Red or Mottled Staffordshire Do. (Peakes)	50 9	per 1,000 ,, ,,
Hip tiles	4 1	per doz. ,, ,,
Valley tiles	3 8	,, ,, ,,

WOOD.

BUILDING WOOD.—YELLOW.

	At per standard. £ s. d.	£ s. d.
Deals: best 3 in. by 11 in. and 4 in. by 9 in. and 11 in.	13 10 0	15 10 0
Deals: best 3 by 9	13 0 0	14 10 0
Battens: best 2½ in. by 7 in. and 8 in., and 3 in. by 7 in. and 8 in.	10 0 0	11 0 0
Battens: best 2½ by 6 and 3 by 6	0 10 0	less than 7 in. and 8 in.
Deals: seconds	1 0 0	less than best
Battens: seconds	0 10 0	,, ,, ,,
2 in. by 4 in. and 2 in. by 6 in.	8 10 0	9 10 0
2 in. by 4½ in. and 2 in by 5 in.	8 0 0	9 0 0
Foreign Sawn Boards— 1 in. by 12 in. by 12 in.	0 10 0	more than battens.
¾ in.	1 0 0	,,
Fir timber: Best middling Danzig or Memel (average specification)	At per load of 50 ft. 4 10 0	5 0 0
Seconds	4 5 0	4 10 0
Small timber (8 in. to 10 in.)	3 12 6	3 15 0
Swedish balks	2 15 0	3 0 0
Pitch-pine timber (30 ft.)	3 0 0	3 10 0

JOINERS' WOOD.	At per standard.	
White Sea: First yellow deals, 3 in. by 11 in.	22 0 0	23 0 0
3 in. by 9 in.	20 0 0	21 0 0
Battens, 2½ in. and 3 in. by 7 in.	15 0 0	16 0 0
Second yellow deals, 3 in. by 11 in.	17 0 0	18 0 0
,, ,, 3 in. by 9 in.	15 10 0	16 10 0
Battens, 2½ in. and 3 in. by 7 in.	12 0 0	13 0 0
Third yellow deals, 3 in. by 11 in. and 9 in.	12 10 0	13 10 0
Battens, 2½ in. and 3 in. by 7 in.	10 10 0	11 10 0
Petersburg: first yellow deals, 3 in. by 11 in.	19 0 0	20 0 0
Do. 3 in. by 9 in.	16 0 0	17 0 0
Battens	12 10 0	13 0 0
Second yellow deals, 3 in. by 11 in.	14 0 0	15 0 0
Do. 3 in. by 9 in.	13 0 0	14 0 0
Battens	11 0 0	12 0 0
Third yellow deals, 3 in. by 11 in.	11 10 0	12 10 0
Do. 3 in. by 9 in.	11 0 0	12 0 0
Battens	10 0 0	11 0 0
White Sea and Petersburg:— First white deals, 3 in. by 11 in.	13 10 0	14 10 0
,, ,, ,, 3 in. by 9 in.	12 10 0	13 0 0
Battens	10 10 0	11 10 0
Second white deals 3 in. by 11 in.	12 10 0	13 10 0
,, ,, ,, 3 in. by 9 in.	12 0 0	12 10 0
,, ,, ,, battens	9 10 0	10 10 0
Pitch-pine: deals	16 0 0	18 0 0
Under 2 in. thick extra	0 10 0	1 0 0
Yellow Pine—First, regular sizes	32 0 0	33 10 0
Broads (12 in. and up)	2 0 0	more.
Oddments	22 0 0	24 0 0
Seconds, regular sizes	24 10 0	26 10 0
Yellow Pine Oddments	20 0 0	22 0 0
Kauri Pine—Planks, per ft. cube	0 3 6	0 4 6
Danzig and Stettin Oak Logs— Large, per ft. cube	0 2 6	0 3 0
Small ,, ,,	0 2 3	0 2 6
Wainscot Oak Logs, per ft. cube	0 5 0	0 5 6
Dry Wainscot Oak, per ft. sup. as inch	0 0 8	0 0 7
¾ in. do. do.	0 0 7	- - -
Dry Mahogany— Honduras, Tabasco, per ft. sup. as inch	0 0 9	0 0 11
Selected, Figury, per ft. sup. as inch	0 1 6	0 2 0
Dry Walnut, American, per ft. sup. as inch	0 0 10	0 1 0
Teak, per load	16 0 0	20 0 0
American Whitewood Planks— Per ft. cube	0 3 0	0 3 6
Prepared Flooring—	Per square.	
1 in. by 7 in. yellow, planed and shot	0 13 0	0 16 6
1 in. by 7 in. yellow, planed and matched	0 13 6	0 17 6
1¼ in. by 7 in. yellow, planed and matched	0 15 0	1 0 0
6 in. at 6d. per square less than 7 in.		
1 in. by 7 in. white, planed and shot	0 11 0	0 12 6
1 in. by 7 in. white, planed and matched	0 11 6	0 13 6
1¼ in. by 7 in. white, planed and matched	0 13 6	0 15 6
6 in. at 6d. per square less than 7 in.		

PRICES CURRENT (*Continued*).

JOISTS, GIRDERS, &c.

	In London, or delivered Railway Vans, per ton. £ s. d.	£ s. d.
Rolled Steel Joists, ordinary sections	6 5 0	7 5 0
Compound Girders ,, ,,	8 0 0	9 0 0
Angles, Tees and Channels, ordinary sections	8 2 6	9 2 6
Flitch Plates	8 10 0	0 0 0
Cast Iron Columns and Stanchions, including ordinary patterns	7 0 0	8 0 0

METALS.

	Per ton, in London. £ s. d.	£ s. d.
IRON— Common Bars	8 0 0	8 10 0
Staffordshire Crown Bars, good merchant quality	8 10 0	9 0 0
Staffordshire "Marked Bars"	10 10 0	- -
Mild Steel Bars	9 0 0	9 12 0
Hoop Iron, basis price	0 5 0	9 15 0
,, ,, galvanised	16 0 0	- - -
(* And upwards, according to size and gauge.)		
Sheet Iron, Black.— Ordinary sizes to 20 g.	10 0 0	- - -
,, ,, to 24 g.	11 0 0	- - -
,, ,, to 26 g.	12 10 0	- - -
Sheet Iron, Galvanised, flat, ordinary quality.— Ordinary sizes, 6 ft. by 2 ft. to 3 ft. to 20 g.	12 10 0	- - -
,, ,, 22 g. and 24 g.	13 0 0	- - -
,, ,, 26 g.	14 0 0	- - -
Sheet Iron, Galvanised, flat, best quality:— Ordinary sizes to 20 g.	16 10 0	- - -
,, ,, 22 g. and 24 g.	17 0 0	- - -
,, ,, 26 g.	18 10 0	- - -
Galvanised Corrugated Sheets.— Ordinary sizes, 6 ft. to 8 ft. 20 g.	12 10 0	- - -
,, ,, 22 g. and 24 g.	13 0 0	- - -
,, ,, 26 g.	14 0 0	- - -
Best Soft Steel Sheets, 6 ft. by 2 ft. to 3 ft. by 20 g. and thicker	12 5 0	- - -
,, ,, 22 g. and 24 g.	13 5 0	- - -
,, ,, 26 g.	14 5 0	- - -
Cut nails, 3 in. to 6 in. (Under 3 in. usual trade extras.)	9 10 0	10 0 0

LEAD, &c.

	Per ton, in London. £ s. d.	£ s. d.
LEAD—Sheet, English, 3 lbs. & up,	12 15 0	- - -
Pipe in coils	13 5 0	- - -
Soil Pipe	15 15 0	- - -
ZINC—Sheet— Vieille Montagne ton	24 10 0	- - -
Silesian	24 0 0	- - -
COPPER— Strong Sheet per lb.	0 1 0	- - -
Thin ,,	0 1 1½	- - -
Copper nails ,,	0 1 1½	- - -
BRASS— Strong Sheet ,,	0 0 11	- - -
Thin ,,	0 1 1	- - -
TIN—English Ingots ,,	0 1 3	- - -
SOLDER—Plumbers' ,,	0 0 6½	- - -
Tinmen's ,,	0 0 5	- - -
Blowpipe ,,	0 0 0	- - -

ENGLISH SHEET GLASS IN CRATES.

15 oz. thirds	2¾d. per ft. delivered.
,, fourths	2¾d. ,, ,,
21 oz. thirds	3½d. ,, ,,
,, fourths	3½d. ,, ,,
26 oz. thirds	4¼d. ,, ,,
,, fourths	4¼d. ,, ,,
32 oz. thirds	5¼d. ,, ,,
,, fourths	5¼d. ,, ,,
Fluted sheet, 15 oz.	3½d. ,, ,,
,, 21 ,,	4½d. ,, ,,
½ Hartley's Rolled Plate	2½d. ,, ,,
⅜ ,, ,, ,,	2¾d. ,, ,,
¼ ,, ,, ,,	2¼d. ,, ,,

OILS, &c.

		£ s. d.
Raw Linseed Oil in pipes	per gallon	0 2 8
,, ,, ,, in barrels	,,	0 2 6
,, ,, ,, in drums	,,	0 2 11
Boiled ,, ,, in pipes	,,	0 2 10
,, ,, ,, in barrels	,,	0 2 11
,, ,, ,, in drums	,,	0 3 1
Turpentine, in barrels	,,	0 2 3
,, in drums	,,	0 2 6
Genuine Ground English White Lead	per ton	21 0 0
Red Lead, Dry	,,	21 0 0
Best Linseed Oil Putty	per cwt.	0 2 6
Stockholm Tar	per barrel	1 12 0

VARNISHES, &c.

	Per gallon. £ s. d.
Fine Elastic Copal Varnish for outside work	0 16 6
Best Elastic Copal Varnish for outside work	1 0 0
Best Elastic Carriage Varnish for outside work	0 15 0
Best Hard Oak Varnish for inside work	0 10 6
Best Extra Hard Church Oak Varnish for inside work	0 10 6
Fine Hard Copal Varnish for inside work	0 16 0
Best Hard Copal Varnish for inside work	1 0 0
Best Hard Carriage Varnish for inside work	0 16 0
Extra Pale Paper Varnish	0 12 0
Best Japan Gold Size	0 10 6
Best Black Japan	0 16 0
Oak and Mahogany Stain	0 9 0
Brunswick Black	0 8 6
Berlin Black	0 16 0
Knotting	0 10 0
Best French and Brush Polish	0 10 0

TO CORRESPONDENTS.

J. B.—T. B. T. (Amount should have been stated.)

NOTE.—The responsibility of signed articles, letters, and papers read at meetings rests, of course, with the authors.

We cannot undertake to return rejected communications.

Letters or communications (beyond mere news items) which have been duplicated for other journals are NOT DESIRED.

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TENDERS.

[Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than 10 a.m. on Thursdays*. N.B.—We cannot publish Tenders unless authenticated either by the architect or the building-owner; and we cannot publish announcements of Tenders accepted unless the amount of the Tender is given, nor any list in which the lowest Tender is under two, unless in some exceptional cases and for special reasons.]

* Denotes *accepted*. † Denotes *provisionally accepted*.

ASPATRIA (Cumberland).—For the erection of a shop, hall, &c., for Messrs. T. Watson & Sons. Mr. W. G. Scott & Co., architects, Victoria-buildings, Workington:—

Joiner's Work.

H. Finnion, Contractor, Flimby £488 0

Ironwork.

Workington Wagon & Engineering Co., Workington 31 14

£1,019 14

BLAENLLECHAU (near Pontypridd).—For additions to the Blaenllechau Radical Club. Messrs. Griffiths & Jones, architects, Tonypandy and Cardiff:—

J. Ll. Prothero, contractor, Ferndale, near Pontypridd* £615 10 6

BLAINA (Mon.)—For the erection of school buildings, Cwmcelyn, for the Aberystruth School Board. Mr. R. L. Roberts, architect, Abercarn. Quantities by architect:—

D. W. Richards	£2,990 0	D. Powell	£2,635 10
Dd. Lewis	2,800 0	J. Jenkins	2,527 0
W. Phillips	2,756 0	J. Lloyd	2,454 10
A. P. Williams	2,695 0	M. Jenkins	2,448 18
T. Westacott	2,692 10	J. Newcombe, Ebbw Vale*	2,400 0
D. J. Davies	2,679 0		

BUCKHURST HILL (Essex).—For bacteria beds, storm overflow sewer, &c. Mr. H. Tooley, surveyor Council Offices, Buckhurst Hill:—

J. & T. Binns	£2,021	G. F. Tomlinson	£1,410
W. Coker	1,898	Wilkinson Bros.	1,400
G. Bell	1,823	W. & C. French, Buckhurst Hill*	1,390
Clift Ford	1,740	W. Manders	1,312
F. J. Coxhead	1,560		

BURNLEY.—For the execution of sewage disposal works (extension of tank) for the Rural District Council Mr. S. Edmondson, Surveyor, 18, Nicholas-street, Burnley:—

Ormerod Bros.	£341 3	Cunliffe & Sons	£255 0
J. Wadge	313 16	Berry & Son	220 12
J. & G. Durbury	290 17	Mullen & Durkin, Burnley*	212 0
Clegg Bros.	299 18		

CARDIFF.—For the erection of a car depot, Newport-road, Roath, for the Corporation. Mr. W. Harpur, C.E., Town Hall, Cardiff. Quantities by the Borough Engineer:—

Turner & Sons	£27,032	Symonds & Co.	£23,396
Allan & Sons	25,867	W. T. Morgan	23,196
Evans Bros.	24,478	Lattey & Co.	22,867
Thomas & Sons	24,342	D. W. Davies*	21,998

[All of Cardiff.]

CARDIFF.—For the execution of bridge works for the Corporation. Mr. W. Harpur, C.E., Town Hall, Cardiff. Quantities by the Borough Engineer:—

Frank Ashley	£5,026 1 7	D. W. Davies	£3,824 0 0
Allan & Sons	4,805 4 3	W. T. Morgan	3,760 13 8
Lattey & Co., Ltd.	4,678 10 8	Charles Davies*	3,506 3 5
Turner & Sons	4,484 0 1	[All of Cardiff.]	

CHINGFORD.—For the remainder of roads and sewers on the Rowden Park Estate, Chingford. Mr. T. Wilson, surveyor, 34, New Bridge-street, E.C.:—

French	£3,977	Killingback & Co.	£3,682
Rogers & Co.	3,944	Eli Wilson, Walthamstow*	3,308
Neave & Co.	3,788		

DARTMOUTH.—For alterations to Royal Union inn, for the Plymouth and Torquay Breweries, Ltd. Messrs. E. Appleton & Son, architects, 10, Abbey-road, Torquay. Quantities by Mr. C. Savill Appleton, Paignton:—

Webber & Sons	£683 0	E. Pike	£544 18
Yeo & Sons	630 0	Back & Watts, Dartmouth*	528 0
Rowe & Pillar	610 0		

HORLEY.—For building a pair of cottages and accident ward on the Gatwick racecourse, Horley, Surrey, for Gatwick, Ltd. Messrs. Holland & Sons, architects, Newmarket. No quantities:—

Cheal & Son	£897 10	A. E. Jennings, Horley, Surrey*	£780 0
King & Son	796 10		

[*See also next page.*